Research Article


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1. Introduction

The National Innovation System (NIS) refers to the network designed to drive innovation, which is composed of government, industry, scientific research institutions, and universities [1]. NIS regards knowledge as an important economic resource and learning as an important social process, and thus, the creation, storage, and transfer of new knowledge, skills, and technologies become the NIS functions [2]. According to Etzkowitz and Leydesdorff’s triple helix theory and its extended quadruple helix theory, as an important driver of knowledge innovation, institutions of higher learning promote economic and social development by the cultivation of high-quality talents [3, 4]. Therefore, constant reforms in higher education need to be introduced to adapt to the changes of the times [5, 6]. Curriculum construction is the basis of higher education and teaching, and the core element of talent training [7]. Strengthening curriculum construction is an important guarantee for the improvement of teaching level and talent-training quality. To improve the quality of agricultural higher education in China and redefine the reform direction, the Ministry of Education has held three significant meetings on educational reform, which are the “Ji’an Consensus,” “Beidacang Action,” and “Beijing Guide” at the macro-, meso-, and microlevels [8]. The overall objective of the Implementation

China has been implementing a brand-new reform in agricultural education and teaching, and the construction of a first-class curriculum is an important guarantee for improving teaching quality and talent training. In line with the survey results of senior students from the field of landscape architecture, 15 frequent elements are selected, namely, teaching team, teaching strategy, teaching method, curriculum ideology and politics, online teaching, offline teaching informatization, teaching material resources, hardware resources, social resources, curriculum structure, teaching process, curriculum organization, applicability, foresight, innovation, and practicality. According to affiliation relationships, they are then classified into five clusters, which are curriculum intelligence support, informatization, resources, normalization, and content. By adopting the analytic network process method and using the super decision software, the hierarchical network model reflecting the dependence and feedback relationship between elements is established. The research results show that, among the five clusters, curriculum content and intelligence support weight relatively are high, which account for 67% of the total weight. The elements of the teaching team, online teaching, teaching material resources, teaching process normalization, and applicability and practicality of curriculum content weigh high, respectively, among the clusters. In the overall ranking of the system weight, the weights of three elements exceed 0.1, namely, the teaching team, content practicability, and teaching process normalization. The weights of the top eight elements account for approximately 85% of the total weight. This study can be used as a reference for the optimal allocation of curriculum construction resources.
Opinions of the Ministry of Education on the Construction of First-class Undergraduate Curriculum has clearly stated that, about 10,000 national and 10,000 provincial first-class undergraduate courses should be established in about 3 years [9]. In essence, the construction of a first-class curriculum is a deep reform of curriculum teaching with the curriculum as the carrier, by constantly absorbing new resources and ideas, including the need for talent training and the development frontier of professional and technical fields, as well as leading educational technology, so as to promote the development of higher education teaching quality [10]. The construction of a first-class curriculum is a new challenge for higher education in China, which needs to be conducted under the framework of standardization and normalization. Therefore, it is urgent to establish the corresponding curriculum evaluation system.

Landscape architecture aims to cultivate talents in the areas of ecological construction and environmental beautification for society [11]. It has the characteristics of strong applicability and wide interdisciplinary knowledge. Students in the area need to master the knowledge and abilities of art, ecology, plants, design, engineering, and so forth. The curriculum has a significant impact on the high-quality training of talents. Psychological effects affect user satisfaction. Similarly, learning psychology impacts the curriculum, positively or negatively [12, 13]. However, a series of deep-seated problems are exposed in the process of the implementation of the existing curriculum; for example, the curriculum fails to meet the learning psychological needs of students, and the curriculum evaluation system overlooks the complex relationship impacting the indexes, among others [14]. These problems prevent the curriculum evaluation results from fully and truly reflecting the problems in the teaching process and fail to help teachers and teaching managers obtain accurate teaching feedback information. Therefore, it is of utter importance to establish a curriculum evaluation system that combines learning psychological needs and expert decision-making.

The analysis of learning psychological needs aims to enable educators to develop appropriate educational programs and strategies according to student learning needs [15]. The theory holds the belief that, in curriculum development, the main principles that should be followed are improving teaching methods, adjusting teaching according to different groups, and training the learning of students, whereas the latter two are about fully understanding their learning psychological needs [16, 17]. From the perspective of psychology, needs refer to the disparity between the current and anticipated result, which is a kind of psychological state of people. Regarding students, learning psychological needs originate from their psychological tendency to pursue academic achievement, which is the subjective reflection of the objective requirements of society, family, and school on students. The learning aspirations and preferences of learners on the subjective level cover not only the deficiencies received under the current learning emotion but also the goals and needs generated by employment needs, including ability, curriculum, teaching, teacher, practical, and learning resource needs [18, 19].

Self-determination theory (SDT) is a humanistic and human-oriented theory of motivation, which insists that higher academic achievement can be made when three psychological needs, namely, autonomy, competence, and relevance, are met [20]. The integrative model of learning and motivation (IMLM), developed based on SDT, suggests that the development of a student-centered learning environment is essential for enhancing perceived knowledge transferability by meeting students’ needs for autonomy, competence, and relevance [21]. The existence, relatedness, and growth (ERG) theory revise Maslow’s hierarchy of needs into three domains: existence, relatedness, and growth. They are considered to have an important influence on the learning motivation of students [22]. Research shows that learning motivation has a significant impact on students' academic performance. If teachers and administrators wish students to be more hard-working and involved in the class, they should first determine students' learning values and expectations for specialized courses and then provide them with corresponding materials [23]. Students typically give the highest rankings to easy courses, extra credits, good grades, simple tests, appropriate coursework, and valuable information [24]. Good grades become the highest-rated factor in each subgroup, and high course standards are among the least popular factors, whereas well-organized classes, timely feedback from teachers, and relevant class discussions are mid-ranking factors [25]. In terms of online learning, appropriate teaching design and suitable learning activities are important factors in attracting learners, which is mainly reflected by student enthusiasm [26].

Bloom divides the teaching objectives in cognitive learning into six levels, namely, remembering, understanding, applying, analyzing, evaluating, and creating, of which the last three belong to advanced abilities [27]. The outcome-based education (OBE) theory, which is the mainstream education concept in the educational reform of developed countries, emphasizes more on advanced abilities, such as creative thinking, analysis and comprehensive information, and planning and organization abilities [28]. The ARCS model contains four levels: attention, reason, confidence, and satisfaction, which focus on how to mobilize the learning motivation of students through teaching design [29]. Those high-quality educational ideas should be based on the curriculum. Therefore, how to evaluate the curriculum has become a common concern among many experts.

The course evaluation system is a diagnostic and normative approach to evaluating the quality of a course and recommending remedial measures [30]. Rampichini et al. developed a university course evaluation method based on a multilevel model [31]. Xu et al. evaluated the influencing factors of the curriculum by multiple regression analysis [32]. When the relationship between the influencing factors of courseware evaluation is complicated, the BP neural network model is superior to other models in solving such nonlinear system problems [33]. Based on the positive deviance model, Whited et al. evaluated the effectiveness of a new food safety curriculum [34]. The analytic hierarchy process (AHP) method, a simple, flexible, and practical multicriteria decision-making method, is widely applied. Chen et al. proposed a
new framework for teaching performance evaluation based on fuzzy AHP and the fuzzy comprehensive evaluation method [35]. Thanassoulis et al. conducted higher education and teaching performance evaluations based on AHP and data envelopment analysis [36]. Zhang developed a mathematical model for teaching evaluation based on the Delphi AHP method [37]. However, those methods do not consider the feedback relationship between curriculum evaluation indexes, which have a widespread existence [38]. The AHP method is one of the most commonly used methods in course evaluation. However, based on a simple hierarchy, the AHP method ignored the complex dependence and feedback relationship between influencing factors. Professor Chen et al. proposed a decision-making method named ANP, which is suitable for a nonindependent feedback system based on the AHP method [39]. Chung et al. identified the important factors affecting course satisfaction based on the ANP method [40]. Choi and Jeong developed an evaluation model of multimedia content quality for online learning systems based on the ANP method, which reflected the correlations among four major quality clusters and 19 subattributes [41]. Kadoić et al. developed a new approach for strategic decision-making in higher education based on ANP and social network analysis [42].

Weight setting is the core link in constructing a first-class curriculum evaluation system, and its accuracy will directly affect the objectivity of evaluation. Group decision-making plays a key role in obtaining an accurate and reliable ranking [43–45]. In most cases, group decision-making members consist of experts in the field, and they are required to have a clear understanding of the method and be free from doubt or confusion [46]. If the decision makers in the decision-making group are given equal decision-making weight, the decision-making group is affirmative; otherwise, it is a heterogeneous decision-making group [47]. Although the experts might come from different backgrounds, their decision-making weight is equal. A judgment matrix consisting of some experts can be synthesized into a comprehensive judgment matrix by using the weighted geometric mean method in the matrix judgment stage to complete the group decision process.

The curriculum is an organic combination of teachers, students, and teaching activities. There must be some correlation between the influencing factors extracted by the first-class curriculum evaluation system. The ANP method can effectively solve the dependence and feedback relationships between the indicators. However, the interactive effect of indicators is rarely specified in the current curriculum-related studies using the group decision ANP method. We, therefore, fail to access accurate indicator weights under the interactive effect.

For this purpose, the following research framework is constructed. First, evaluation indicators are selected based on students’ learning psychological needs, and a first-class curriculum evaluation system is constructed by using the ANP model. Afterward, a network structure that can reflect the influence and feedback relationship between indicators is set up, and the interaction between the indicators is clarified. To obtain the indicator weight, the importance degree of the indicators is estimated in the SD software with the help of the group decision-making method. The relative urgency of each indicator in the first-class curriculum construction is finally estimated according to the weight, which provides a basis for the curriculum developer to allocate course resources.

2. Methods

2.1. Evaluation Elements’ Selection. The test in the pre-investigation stage indicated that students lack a clear understanding of professional research terms, but they know, relatively clearly, their own learning psychological needs and can express those needs rather accurately in nonprofessional language. Although some teachers insist that a questionnaire survey has certain limitations, a dialogue-based evaluation method is capable of getting students involved in the discussion about their learning progress and improving both students’ and teachers’ awareness of how to improve the course [48]. Our respondents in this research are mainly junior and senior students majoring in landscape architecture. It is because, after a certain period of learning, students begin to more clearly understand their learning psychological needs. The curriculum evaluation vocabulary that frequently appears is mainly collected at this stage, which is then sorted and classified by the researchers to serve as the elements of the evaluation system construction, and the SD software is used to construct the evaluation model.

2.2. Expert Evaluation. Based on the evaluation model and according to the teaching law and teaching experience, the researchers establish the dependence and feedback relationship between elements and generate the ANP questionnaire. The group decision-making approach aggregates individual preferences and presents the best consistency using mathematical models [49] because a team has more resources, knowledge, and insight than any individual when making important decisions [50]. Six teachers of landscape architecture are selected from higher educational institutions. These experts, with academic titles of associate professor or higher, have professional backgrounds in design, plants, and ecology, and teach courses in planning and design, plants, ecology, engineering, and art, with abundant professional knowledge and teaching experience.

2.3. The ANP Model. The ANP method comprehensively considers the interaction between various factors or the adjacent hierarchy, and it comprehensively analyzes the influencing factors to obtain the weight by using the supermatrix. The ANP method divides elements into the control layer and network layer; the control layer contains problem objectives and decision criteria. All decision criteria are independent of each other and are only dominated by objective elements. The weight of each criterion can be obtained using the AHP method, whereas the network layer comprises all elements dominated by the control layer, and its interior is an interactional network structure [51] (Figure 1).
3. Evaluation System

3.1. Evaluation Elements’ Selection. Through a survey on the learning psychological needs of senior students of landscape architecture and by combining findings with literature search, 15 frequent elements are selected, namely, the teaching team, teaching strategy, teaching method, curriculum ideology and politics, online teaching, offline teaching informatization, teaching material resources, hardware resources, social resources, curriculum structure, teaching process, curriculum organization, applicability, foresight, innovation, and practicality. When selecting the elements, the conceptual dimensions of the evaluation objectives are included as far as possible, and they are equipped with a good hierarchical classification basis. The elements are classified into five clusters according to the category, which are curriculum intelligence support, informatization, resources, normalization, and content (Table 1).

3.2. Relationship between Evaluation Elements. According to the teaching law and teaching experience, the dependence and feedback relationship between elements (Table 2) is determined after analyzing the influence relationship between elements at all levels.

3.3. The ANP Hierarchical Structure. The calculation process of the ANP method is complex, and for this reason, it was not widely used in the early stages of its establishment. Therefore, Öztaysi et al. launched the SD software in 2003, which successfully realized the programming of ANP calculation and laid a solid application foundation for the practical promotion of the ANP method [52]. At present, the ANP method is widely used in research in various fields [53–55]. According to the evaluation system, the correlation structure between index sets is established in the SD software. Each element group (cluster), element node (element), and their corresponding connections are designed. The connections hereby include the connection between nodes within the same element group (called inner dependency), the connection between nodes in different element groups (called outer dependency), and the connection between element groups. In line with the above principles, the ANP structure diagram of the first-class curriculum evaluation system of landscape architecture is built in the SD software 3.2 (Figure 2).

3.4. The ANP Calculation Process. As software is developed aiming at the AHP and ANP methods, the calculation process is consistent with the calculation steps of the ANP method, which is mainly divided into eight steps [56] (Figure 3): establishing a new template, adding clusters, adding elements in the clusters, establishing the element dependence relationship between and within clusters, experts conducting multiple comparisons with the 1–9 scale (Table 3), calculating the arithmetic mean value and the Matrix tool used to input the value (Figures 4 and 5), inputting the statistical result data, and calculating the unweighted super matrix, weighted super matrix, and limit matrix (Table 4) of the ANP model. Finally, the comprehensive dominance of each element can be obtained by using the priority function in the SD toolbar. It should be noted that the final judgment should pass the consistency test in the expert comparison stage to ensure the reliability of judgment [57]. The final judgment is accepted when the consistency ratio (C. R.) < 0.1; otherwise, experts need to adjust it so it is valid for the consistency test [58].
4. Result and Analysis

The weight calculation results can be viewed by using the priority tool of SD software 3.2 (Figure 6 and Table 5).

4.1. Weight Ranking of Clusters. The weight ranking of clusters is curriculum content (0.373434) > curriculum intelligence support (0.297801) > curriculum informatization (0.154536) > curriculum resources (0.102567) > curriculum normalisation (0.071662). The results indicate that curriculum content is of great significance in curriculum evaluation. In fact, the construction of the other four clusters is implemented by taking curriculum content as the starting point. Curriculum content determines the acquisition of knowledge, emotions, and abilities of students and the cultivation of their value. Curriculum intelligence support is of secondary importance. This section mainly reflects the basic requirements of the OBE teaching method. In teaching, teachers need to adjust teaching plans, reform teaching methods and means, cooperate with teaching contents, and improve practical teaching in line with the output and achievement objectives of students, as well as cultivate their correct worldview, outlook on life, and values [59]. Curriculum normalisation ranks third place, which reflects that the curriculum structure should be set, and the teaching process should be strictly implemented according to the professional training objectives in teaching. The construction of curriculum informatization and resources rank in the last two, and their total weight is <20%.

4.2. Weights of Elements in Their Clusters. The teaching team occupies an absolute proportion under the cluster of curriculum intelligence support, while the weights of the other three elements are relatively close. This kind of weight distribution reflects the importance of teaching team construction. The teaching team is the basis of teaching research and activities. The teaching philosophy, teaching management level, teaching experience, personal knowledge and
practice level, and so forth of the team will exert a vital influence on the teaching quality. In fact, excellent teaching teams are equipped with inherent advantages in teaching strategies, teaching methods, and curriculum ideology and politics [60]. The weight ratio of online teaching and offline teaching informatization is 3:2 under the cluster of curriculum informatization. Under the background of an information society, a first-class curriculum should be fully integrated into information-based teaching [61]. In particular, online teaching, which helps break the restrictions of learning time and space of students by adopting the flipped classroom mode, provides students with more diverse learning choices. Teaching material resources occupy an absolute proportion of the cluster of curriculum resources, which means that teaching materials play an extremely important role in curriculum construction [62]. In addition, the cultivation of practical ability is inseparable from the support of certain social resources, such as practice bases, practice enterprises, and managers, all of which play a certain role in promoting the curriculum’s construction. Under the cluster of curriculum normalization, the weight ratio of the teaching process and curriculum structure is about 3:1, and the standardization of the teaching process plays a more important role. Applicability and practicality rank as the top two under the cluster of curriculum content, which reflects the curriculum requirements for foundation and application. Foresight and innovation also occupy a certain weight, but they are relatively low.
Figure 3: Main steps of applying the ANP method in SD software.

Table 3: The 1–9 scale and its meaning when comparing two elements in the pairwise matrix.

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<th>Scale</th>
<th>Meaning</th>
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<td>1</td>
<td>The former element is equally important as the latter.</td>
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<td>3</td>
<td>The former element is slightly more important than the latter.</td>
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<td>5</td>
<td>The former element is obviously more important than the latter.</td>
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<td>7</td>
<td>The former element is especially more important than the latter.</td>
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<td>9</td>
<td>The former element is significantly more important than the latter.</td>
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<td>2, 4, 6, 8</td>
<td>Take the median of the above two adjacent judgments.</td>
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<td>Reciprocal</td>
<td>The importance scale of the latter element over the former.</td>
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Figure 4: Pairwise comparison matrix (in the cluster of curriculum intelligence support).

Figure 5: Pairwise comparison matrix (in the cluster of curriculum resources).
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In the ranking of elements overall, the weights of three elements exceed 0.1, which are teaching team, content practicability, and normalization of the teaching process, respectively, showing that they play an important role. In addition, the weights of five elements exceed 0.05, which are teaching strategy, foresight of curriculum content, online teaching, innovation of curriculum content, and teaching material resources, respectively, showing that they play a moderately important role. The weights of the top eight elements account for 84% of the total weight, while those of the remaining seven elements are <0.05, respectively, thus playing a slightly important role in
curriculum construction. It is worth noting that the curriculum's ideology and politics indicators are also lower weighted. The inclusion of this indicator is mainly determined by Chinese education characteristics. To cultivate students' values and emotions, the Ministry of Education of the People's Republic of China issued the Guidelines for the Construction of Curriculum Ideology and Politics in Higher Education, which requires the practice of ideological and political education in the talent-training system and curriculum system. On this basis, it is included as one of the curriculum construction indicators in the research.

5. Discussion

The weights of some elements are rather high in the results of this research. Furthermore, the weight of the teaching team is 3.57 times the average value of all elements, showing that it is of vital importance in curriculum construction. This situation is closely related to the faculty resource status of landscape architecture. A doctoral degree is usually required to teach in Chinese higher educational institutions, but there are few authorization points for a doctoral degree in landscape architecture in China. The number of doctors trained is far less than required. Consequently, there has been a general lack of teachers in landscape architecture, and they have not been supplemented for a long time, which has seriously affected the teaching quality of the program and curriculum to a certain extent. Therefore, experts are paying high attention to this. The high weight of curriculum content applicability is closely related to the program characteristics. As a program combining theory and application, landscape architecture has a strong career orientation. Therefore, whether the curriculum can meet employment requirements has become one of the important evaluation factors. The weight of online teaching (0.061154) is merely close to the average weight of all elements (0.06667). With the rapid construction of online open courses in China recently [63], many national and provincial mainstream online open courses in landscape architecture have been built, which can basically meet the requirements of curriculum teaching. In contrast, despite the rapid development of online teaching, there are many problems in the actual process, such as low learning efficiency and low utilization rate [64, 65]. Computer-supported collaborative learning has already been proven to greatly facilitate learning, but it is often criticized for hindering the initiative of learners, thus undermining their enthusiasm. In some cases, Massive Open Online Courses (MOOCS) may make it difficult for learners who are not familiar with the new learning environment to adapt [66], and the design and teaching of MOOCS has a limited impact on them [67]. Therefore, blended learning and other technological innovations are rapidly changing teaching and learning in higher education [68]. The construction of teaching material resources is also one of the problems faced by the landscape architecture curriculum. For a long time, the teaching materials construction of the landscape architecture curriculum lags behind the curriculum construction and is far from keeping up with the speed of knowledge renewal [69].

The ANP method proposed by Saaty can solve the decision problems with complicated impact and feedback relationships, especially risk assessment, optimal resource allocation, and solution optimization [70, 71]. The application of this method in evaluating the weight calculation of indicators with the support of SD software can simplify complicated decision problems, and it is quite suitable for the evaluation of education, curriculum, and learning. However, as mentioned by Sava et al., in most cases, the information involved and used in the decision-making process is limited or incomplete, so it is significant to enhance the model stability [72].

This research has some limitations. The first is the possible negligence of potential important influencing factors in the investigation of the learning and psychological needs of students. Future research should probe into this problem from different angles and explore as many influencing factors as possible. Although the dependence and feedback relationship has been accounted for as much as possible in terms of the relationship between influencing factors, the judgment is mainly based on teaching experience. Therefore, it is necessary to further test, optimize, and adjust the evaluation system in practice to obtain more accurate results. The group decision used in this research aims to give full play to collective wisdom, but there is no doubt that more studies would yield more representative results.

Cost-benefit analysis is essential for evaluating resource allocation efficiency [73]. This economic decision-making method is applied to curriculum construction in order to find the solution to obtain the maximum benefit at the lowest cost in the curriculum investment decision. The essence of first-class curriculum construction lies in comprehensive curriculum reform and quality improvement. It is crucial to obtain higher benefits when the cost of input remains fixed. The weight reflects the contribution or importance of the indicator, demonstrating the construction urgency of curriculum indicators to some extent; thus, it can be used as a vital reference basis for resource allocation in curriculum construction.

This study’s emphasis is on the weight of elements; however, in future research, the grading and scoring criteria of each element should also be clarified. Furthermore, a complete operable evaluation system should be developed based on the weight of elements. In addition, the applicability of the model should be tested and corrected to make it more usable to better satisfy students’ learning needs and achieve teaching goals.

6. Conclusion

By adopting the ANP method and based on the learning psychological needs of students and the evaluation of experts, this research constructs the evaluation system of the first-class curriculum of landscape architecture and weights their respective elements with the help of the convenient network analysis function of SD software. The evaluation system has integrated the psychological needs of students and the education and teaching experience of experts, and
it is constructed from the two aspects of learning and teaching. The weight values reflect the importance of elements in curriculum evaluation, which can provide a scientific basis for curriculum construction and evaluation and help speed up the standardization and normalization of first-class curriculum construction. The network-adopted hierarchical method helps avoid the disadvantages caused by neglecting the interaction and feedback relationships between elements in traditional methods, and it can objectively reflect the interdependence and feedback relationship between curriculum construction elements. Compared with other methods, the ANP method shows strong operability and is easy to learn with the help of SD software. Furthermore, it is suitable for all education and teaching-related evaluations, such as curriculum evaluation and effect evaluation.

Using a questionnaire survey on learning psychological needs, this study has mastered the basic curriculum requirements of landscape architecture students, which can help construct a curriculum evaluation system based on the psychological needs of students, making it more suitable for the objective situation of their learning. Through the method of expert evaluation, the weight of curriculum evaluation is obtained, which is conducive to the standardization of curriculum construction. Our results show that the influencing factors of the first-class curriculum construction of landscape architecture are miscellaneous, but there is a complex dependence and feedback relationship between them, which is not a one-way relationship of traditional understanding. In addition, the results also show that the elements in curriculum construction are not necessarily equally important; rather, there are great differences in the degree of importance. When making teaching investments, there should be a balance between personnel, management, and capital investment, and it should be attempted to meet the requirements of high-weight elements with limited investment sources.

This study’s results can provide a basis for investment in curriculum construction. The curriculum investment is divided into personnel, management, and capital investment. The curriculum intelligence support and curriculum content, which are under the cluster, belong to personnel investment; the curriculum normalization mainly belongs to management investment, whereas the curriculum informatization and curriculum resources belong to capital investment. The weight of the curriculum evaluation element can be used as the reference basis for curriculum construction investment. Higher profits can be obtained by selecting elements with a higher weight according to the type of investment source.

**Data Availability**

The datasets generated for this study can be obtained from the corresponding author upon request.

**Conflicts of Interest**

The authors have no conflicts of interest.

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