

# Construction of Evaluation Index System of Primary School Students' Learning Performance

Rui Huang

Sichuan University of Arts and Science, Dazhou Sichuan, 635000, China

## Abstract

**Through the use of analytic hierarchy process to construct a learning performance evaluation index system; analyze the factors that affect learning performance in the learning process of primary school students, provide data support and reference basis for primary school students to improve learning performance, and provide support services for the development of personalized learning.**

## Keywords

**Learning performance, analytic hierarchy process, evaluation index.**

## 1. Introduction

The 21st century is the era of informatization. "The development of information technology is changing people's ways of living and learning at an alarming rate. Knowledge is being updated faster and faster. The key to improving one's own ability lies not only in learning, but also in Efficient learning"[1]. "Performance", "as a quantitative indicator to measure the effectiveness of the output of various behaviors of individuals or organizations"[2], how to organically integrate the maturing performance concepts with educational theories has become an urgent topic for scholars in the education field for further research.

## 2. Learning performance

At present, there are many domestic studies on "learning performance", which explore the factors that affect learning performance from a macro level or a theoretical perspective, and empirical strategies occupy the dominant position; foreign scholars' research on learning performance mainly focuses on students In the four aspects of performance measurement in a certain discipline, the study of distance learners' learning performance, the study of student performance evaluation methods and evaluation standards, and the study of using performance technology to improve learning performance, theoretical research and practical research are relatively mature. Scholars generally believe that there is a positive correlation between learning performance and learning motivation and learning ability[3]. Zhao Huiqiong believes that "learning performance is not only inseparable from the process of students' learning behavior, but also closely related to the results of students' learning performance. Therefore, learning performance is defined as a series of behaviors and behaviors produced by students throughout the learning process from determining the goal to completing the goal. The sum of skills, emotional attitudes and results"[4]. Yang Minming defined learning performance as "the implicit or explicit behavioral results shown by students in their preparation, learning process, and learning results."[5] In the 1930s, Taylor and others put forward the concept of educational evaluation. And summed up the principles of educational evaluation and curriculum development, forming the famous "target evaluation model". In the mid-1980s, American scholar Carol Dweck proposed a relatively complete theory of achievement goals[6]. In 1999, Canadian scholar Mark Bullen[7] made a comment on "Research on the Performance of Distance Learning in Higher Education". On the basis of referring to the definition of learning

performance by other scholars, this research defines the concept of learning performance as: learning performance includes both the learning process and the result of learning. It is the learner's maximum protection in a limited time period. The construction of meaning in terms of knowledge, skills, emotions, etc. has been fully developed.

### 3. The construction of learning performance evaluation index system

Learning is a process in which learners actively construct meaning of knowledge. Learners' learning ability, learning attitude, learning behavior, and academic results are important factors that affect their learning performance. The American educational psychologist Gagne [8]'s learning outcome classification theory scientifically puts forward five aspects of human learning outcomes: "verbal information, wisdom skills, cognitive strategies, motor skills, and attitudes." These five levels have made a thorough analysis of the learning results of different levels of human beings, covering all possible learning results, and have been universally recognized by most scholars in the world education circle. This research is based on the construction elements of the general index system[9][10] and the principles[11] followed, according to the three stages of divergence, convergence, and correction[12], centered on the core concepts of learning performance, and guided by the theory of learning results classification Construct an indicator system: First, set the evaluation target (primary school students' learning performance) as X, decompose it, analyze in-depth the relevant literature on learning performance of senior scholars at home and abroad, comprehensively consider the factors affecting learning performance, and put forward a detailed preliminary Proposed first-level index items; formulate questionnaires based on the proposed preliminary first-level indicators, conduct surveys and interviews with relevant experts, scholars, teachers, staff, and school pupils in the field, then collect the questionnaires, eliminate invalid questionnaires, and test Analyze the data, and combine the collated interview records, as well as the revised opinions of experts, teachers, scholars, etc., and use the least mean square error method[13] to screen and revise to determine the formal first-level indicators. Secondly, according to the determined first-level index items, according to the above method, the second-level index items and the third-level index items are determined in turn. Among them, the construction of the third-level index items draws on the influencing factors of learning performance proposed by Huang Tianhui et al.[14], Shi Zhanbo[15] developed a matrix of mixed learning performance influencing factors, and the classroom learning performance ISM model constructed by Jia Bin[16]. Finally, an evaluation index system for pupils' learning performance is formed, as shown in Table 4.

#### 3.1. Analytic hierarchy process to determine the index weight

Weight, "also known as weight coefficient, refers to the number used to indicate the proportion of each indicator in the whole when a whole is decomposed into several indicators." [17], the weight of each indicator represents the overall evaluation of the indicator The relative importance in the system. The set of these weight coefficients is called the weight set, which reflects the relationship between a single indicator and other indicators. The analytic hierarchy process is to "objectively describe people's subjective judgments of things, express and deal with them in forms, list the priority order of the indicators in the indicator system through comparison between factors, construct a judgment matrix to calculate the weight, and finally perform a judgment matrix Consistency test." [18] The use of analytic hierarchy process to quantify the fuzzy factors in education evaluation can effectively make up for the deficiencies of fuzzy mathematical methods, improve the scientificity and accuracy of education evaluation, and is easy for educators to grasp and apply. The sample involved in this study is small, and there is no obvious rule for determining the weight of the index items. Therefore, this study

uses the analytic hierarchy process to determine the weight of the indicator system, and the specific steps are as follows:

(1) Build a tree-like hierarchical structure model. In learning performance evaluation, the evaluation index system is the model, as shown in Figure 1.

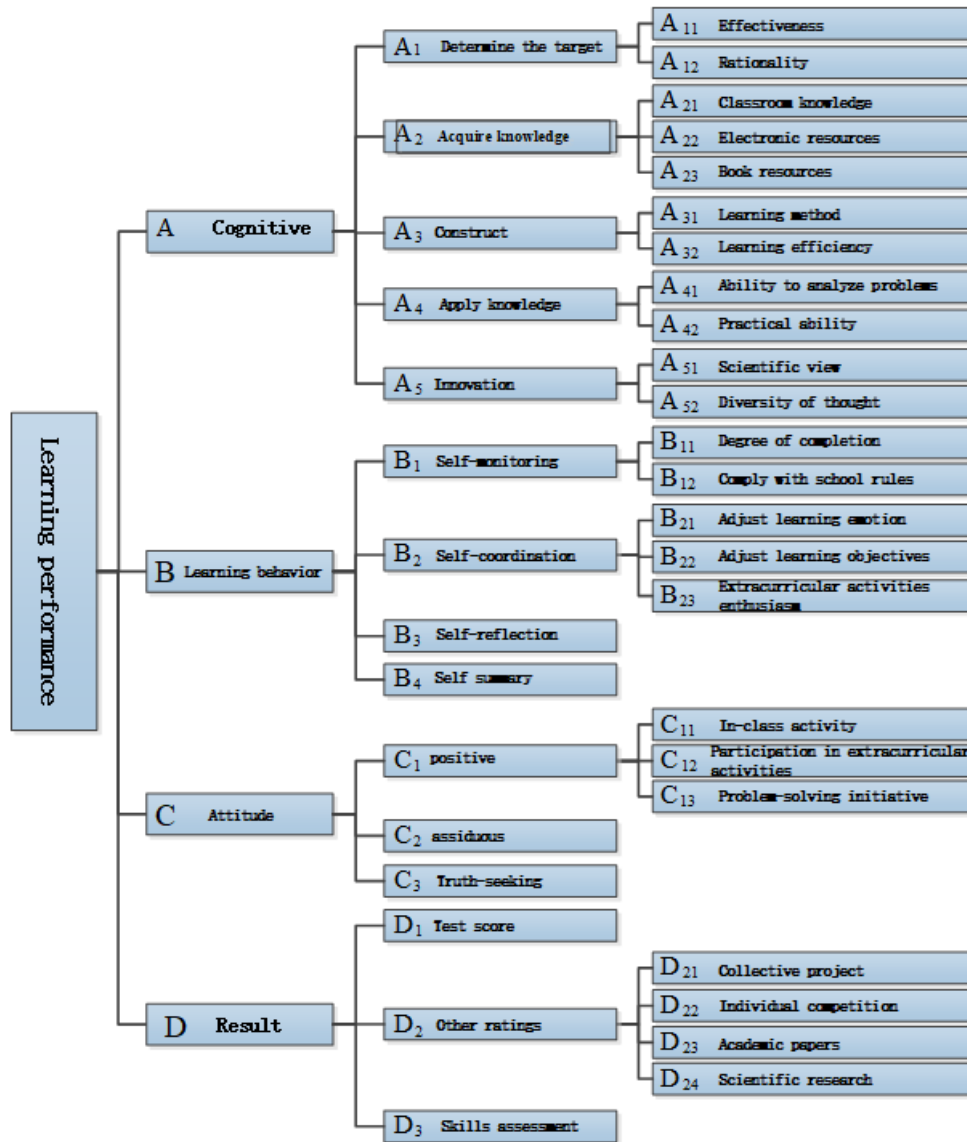


Figure 1: The model diagram of the hierarchical structure of pupils' performance evaluation  
 (2) Determine the quantitative scale of judgment. Use the 1-9 scale method (as shown in Table 1) to compare each index in the index system according to the importance level.

Table 1: Relative importance level table

Relative importance	meaning
1	Factors are equally important
3	Factors are compared, one of which is slightly more important
5	Factors are compared, one of which is obviously important
7	Factors are compared, one of them is really important
9	Factors are compared, one of which is absolutely important
2,4,6,8	The middle value of two adjacent judgments

Table 2: Conversion table of performance evaluation grades

Rank	Excellent	Good	Medium	Pass	Poor
	A	B	C	D	E
Value	1.0	0.8	0.6	0.4	0.2

Table 3: Average random consistency index *R.I.*

n	1	2	3	4	5	6	7	8	9
<i>R.I.</i>	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45

(3) Construct a judgment matrix. Through the pairwise comparison of the index items, the importance of the influence of the index items of the next layer on the target of the upper layer is determined, and the qualitative judgment is quantified, that is, the judgment matrix is constructed. At this stage, the determined primary school student performance evaluation index system and the 1-9 scale method were compiled into questionnaires, and questionnaire surveys and interviews were conducted with our school's students, teachers and related experts. This time 450 questionnaires were distributed and 417 questionnaires were returned. Through the analysis of the validity and reliability of the questionnaire, excluding questionnaires with lower reliability and validity, there are 386 valid questionnaires, accounting for 92.566% of the total number of questionnaires returned. Then build a judgment matrix based on the data recovered through analysis. Taking the indicator "A1's ability to determine goals" as an example, the matrix constructed is as follows formula (1):

$$A_1 = \begin{Bmatrix} 1 & A_{12} \\ A_{11} & 1 \end{Bmatrix} = \begin{Bmatrix} 1 & 0.6 \\ 1.67 & 1 \end{Bmatrix}. \tag{1}$$

(4) Calculate the maximum characteristic value. In Matlab software, the eigenvalues of the judgment matrix A can be calculated using the operation command. Use formula (2) to calculate the weight vector for the target.

$$Aw = \lambda_{\max} w_i. \tag{2}$$

Among them,  $w = (w_1, w_2, \dots, w_n)^T$  is the  $\lambda_{\max}$  corresponding feature vector, that is, the weight coefficient. Calculate the corresponding feature vector, and then normalize it to get the weight value.

(5) Consistency inspection. Although the construction of the judgment matrix can reduce the interference of other factors to a certain extent, it is inevitable that there will be inconsistencies. Therefore, it is necessary to quantify and check the consistency of these data. In order to reflect the degree of consistency of the judgment matrix, *C.I.* (Consensus index)[18] is defined, as shown in formula (3).

$$C.I. = \frac{\lambda_{\max} - n}{n - 1} \text{ (n is the order of the matrix)}. \tag{3}$$

When *C.I.*=0, it means that the matrix A has complete consistency, and when *C.I.* approaches 0, it means that the matrix has a satisfactory consistency. If *C.R.*= *C.I.*/*R.I.*≤0.10, the consistency of the judgment matrix is considered acceptable. Among them, *R.I.* means that the eigenvalues of the random judgment matrix are calculated repeatedly and averaged. Here we introduce Saaty's average random consistency index *R.I.*[18], as shown in Table 3. By calculating the *C.R.* of all the judgment matrices are less than 0.10, so the judgment matrices constructed in this study have satisfactory consistency. Finally, the weights of all index items are calculated, as shown in Table 4.

### 3.2. Formulate the evaluation standards in the evaluation index system of primary school students' learning performance

The description of common evaluation standards mainly includes three forms: "descriptive standard, expected comment scale standard, objective countable grade standard". In this study, students' learning performance abilities, behaviors and attitudes are expected to be rated as a scale, and each indicator is divided into five grades: excellent, good, medium, passing, and poor, with values of 1.0, 0.8, 0.6, and 0.4 respectively. , 0.2; The evaluator scores according to these five grades, calculates the score, and then converts the grade according to the performance evaluation grade conversion table (shown in Table 2).

According to the above steps: the selection and revision of evaluation indicators, the determination of indicator weights, and the formulation of evaluation standards, a complete evaluation index system of primary school students' learning performance is finally formed, as shown in Table 4.

Table 4: Primary school students' learning performance evaluation index system table

Level 1 indicator (weight)	Secondary index (weight)	Three-level indicator (weight)	Evaluation standard	Rank					Score
				A	B	C	D	E	
Cognitive (0.312)	Determine the target (0.0474)	Effectiveness (0.0202)	Develop learning objectives related to the current study, belong to the scope of self-awareness, and take some time to complete.						
		Rationality (0.0272)	Develop learning objectives have a certain degree of difficulty, through some effort to complete, in line with "recent developments."						
	Acquire knowledge (0.0574)	Classroom knowledge (0.0150)	Focus on classroom, under the guidance of teachers to fully grasp the knowledge of major and difficult.						
		Electronic resources (0.0164)	Have a certain ability to retrieve electronic computer skills and resources, to fully obtain efficient use of network resources.						
		Book resources (0.0260)	Make full use of paper-based resource materials, extra-curricular books, libraries and other acquisition-related resources.						
	Construct (0.0537)	Learning method (0.0299)	Good knowledge of memory on the basis of understanding, through practice, to deepen understanding and mastery of concepts.						
		Learning efficiency (0.0238)	In a limited time, quickly and efficiently learn knowledge from the acquired resources and use them.						
	Apply knowledge (0.0821)	Ability to analyze problems (0.0462)	Scientific analysis of problems encountered in the study and find out why and reasonable way to resolve it.						
		Practical ability (0.0359)	It has some experiments and practical skills, practical hands-on skills.						

	Innovation (0.0714)	Scientific view (0.0399)	The views expressed in logical and scientific laws, and innovative.						
		Diversity of thought (0.0315)	For the same problem from different angles, we put forward a variety of perspectives, good from many angles to analyze and solve problems.						
Learning behavior (0.243)	Self-monitoring (0.0586)	Degree of completion (0.0404)	Timely completion of the volume of learning tasks.						
		Comply with school rules (0.0182)	Familiar with and abide by school rules and regulations.						
	Self-coordination (0.0639)	Adjust learning emotion (0.0167)	Good at regulating bad and negative emotions.						
		Adjust learning objectives (0.0311)	Take good learning methods of learning for different learning tasks.						
		Extracurricular activities enthusiasm (0.0161)	Good at adjusting learning goals that are too high or too low.						
	Self-reflection (0.0576)	Regularly study analyzed the status quo, looking for bias and error.							
Self-summary (0.0629)	Regularly summarize the experience and methods of learning.								
learning attitude (0.231)	Positive (0.0598)	In-class activity (0.0168)	Actively speak in class and express your views.						
		Participation in extracurricular activities (0.0139)	Often participate in extracurricular study group activities, and to propose effective recommendations.						
		Problem-solving initiative (0.0291)	Actively face the problems encountered in learning, actively search for relevant materials, and consult others to find ways and means to solve the problems.						
	Assiduous (0.0749)	Reasonably allocate time for preview, review, summary, and practice.							
	Truth-seeking (0.0963)	Pay attention to the understanding and mastery of knowledge, but not excessively pursuing rankings and honors, be down-to-earth, and earnestly investigate doubts about related knowledge.							
	Test score (0.0745)	Based on student exams and test scores.							

Academic results (0.214)	Other ratings (0.0717)	Collective project (0.0131)	According to the relevant standards of the "Student Handbook".						
		Individual competition (0.0163)	According to the relevant standards of the "Student Handbook".						
		Academic papers (0.0242)	According to the relevant standards of the "Student Handbook".						
		Scientific research (0.0181)	According to the relevant standards of the "Student Handbook".						
	Skills assessment (0.0678)	According to the relevant standards of the "Student Handbook".							
Total score									

Note: After all the scores are filled in, calculate the score of each indicator in turn, score = weight \* grade score \* f (f=100); grade scores are converted according to Table 2. The total score ≥90 is considered excellent, 80-90 is good, 70-80 is medium, 60-70 is passing, and ≤60 is poor.

#### 4. Conclusion

By constructing an evaluation index system for primary school students' learning performance, this study clearly reflects the impact of cognitive ability, learning attitude, and learning behavior on learning performance, and provides data support for primary school students to improve their learning performance. In follow-up research, the collection of learning performance data will be further expanded, and the factors that affect primary school students' learning performance will be further explored and analyzed. We will pay attention to primary school students' learning styles from multiple dimensions and aspects, and formulate intervention measures and help plans in time based on the evaluation results to promote primary school students' learning performance. Improve and provide support for the development of personalized teaching.

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