

# Exploration of Academic Performance Evaluation in Project-Based Learning

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## Abstract

The main body of project-based learning is students, which is different from the traditional teaching mode where teachers are the main body. So the main body for evaluating academic performance in project-based learning should also be students rather than teachers. However, there is currently very little research on the evaluation of project-based learning performance. This article combines the characteristics and practical experience of project-based learning to explore a set of evaluation standards that combine Mandatory indicators and flexible indicators. This standard has the characteristics of supervision, encouragement, fairness, and flexibility, and has been tested with practical courses. The test result indicates that the evaluation indicators are reasonable and feasible.

## Keywords

Project-Based Learning, Traditional Teaching Mode, Evaluation of Academic Performance, Webpage Design Technology

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## 1. Introduction

There are no relevant research results on “project-based learning performance evaluation” found on CNKI. When querying for “Project based learning achievement evaluation” in IEEE Explore, most of the query results only contain the Project based learning keywords (Herrero-de Lucas, Martínez-Rodrigo, de Pablo, Ramirez-Prieto, & Rey-Boué, 2022; Hernández-Mangas & Álvarez, 2021; Morais, Ferreira, & Veloso, 2021; Yang, 2021), and they are basically related to a certain course (Rengifo & Bravo, 2020; Dogara, Saud, Kamin, & Nordin, 2020; Kondo & Hazeyama, 2022; Galkin & Vorobyov, 2017; Frontera & Rodríguez-Seda, 2021; Clark, Wang, Splain, & Chen, 2020). Only one of them had the

keyword evaluation (Hernández-Mangas & Álvarez, 2021), but the paper studied the role of double-loop current regulator in Power and Control Electronics Technology Application Course. There is currently very little research on the evaluation of project-based learning performance, therefore, it is necessary to explore methods for evaluating academic performance in project-based learning.

Project based learning is student-centered knowledge learning, in which students are the main body and teachers are the guide and assistance. Project based learning can fully unleash students' initiative, cultivate their self-learning ability, and stimulate their internal motivation (Jaime, Blanco, Domínguez, & Arruabarrena, 2022; Ståhl, Sandahl, & Buffoni, 2022; Lopera, Gutiérrez-Velásquez, & Ballesteros, 2022; Fan et al., 2023; Jordens, Wilmart, Garone, Kinnaert, & Caatoire, 2022). Teachers are not the main body of project-based learning, so they cannot judge students' grades solely on their own. To provide final academic performance on the premise of fairness, rationality, not undermining students' learning passion, and respecting students' learning outcomes is a challenging problem for traditional teaching methods that used to be teacher centered (Sahin & Abichandani, 2013). Therefore, project-based learning requires a new set of evaluation standards to evaluate students' academic performance, which need to be supervised, encouraged, fair, and flexible.

#### **The preparation of the research**

In order to study this topic, a detailed record of the students' class situation was taken during the Webpage design technology class, which lasted for 4 months. During this process, Excel is used to record students' completion of each small project and their guidance to others. Rain classroom is used to record students' completion of projects after class. The final test is divided into two parts: one is to test basic knowledge points using Rain classroom, and the other is to practice in the training room.

## **2. Overall Principles of Evaluation Criteria**

In project-based learning, students must fully mobilize their internal learning passion, which is highest when they first enter university. Therefore, the curriculum for new students is very important, and the evaluation of students is even more important. If the evaluation is appropriate, after completing the course, students not only feel that they have gained knowledge, but also feel that their efforts have been recognized. Finally, students are confident in their professional learning and willing to self-study and complete course projects. As a result, it becomes very easy for teachers to manage students, as they only need to provide Q&A guidance and continuously improve their own skills. How to establish a standard for proper evaluation is a question that needs to be studied before the start of each semester's curriculum.

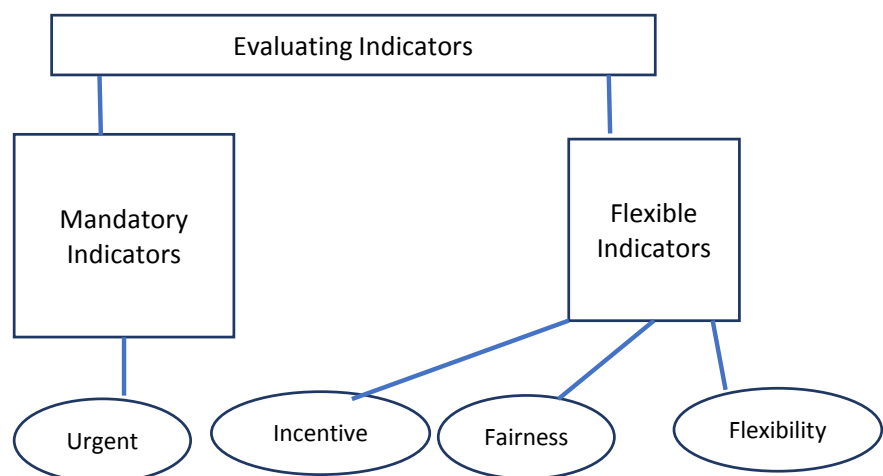
College students just went through the Mandatory preparation for the college entrance examination and wanted to relax in college. However, after entering

college, they found that there were more things than high and middle schools, so after half a semester, there began to be a two-level differentiation. Students with strong learning abilities are very happy to learn, while students with weak learning abilities and insufficient self-discipline begin to become lazy, not striving for improvement, but only seeking to pass. If there is no supervision in the evaluation criteria, some students may become victims of project-based learning because most people have inertia. Urgency is a Mandatory indicator, and students will have internal resistance. Therefore, in addition to Mandatory indicators, there should be reward standards to make students more positive through rewards. Reward indicators also need to have a degree, mainly to encourage students to grow and strengthen their internal drive. Encouragement indicators should not be too arbitrary, as being too arbitrary can easily lead to unfairness. Since it is the evaluation of academic performance, the evaluation results of each student should be different, because academic performance involves the evaluation of students, so the evaluation criteria should be fair. In order to match different course characteristics, the learning evaluation of project-based learning should also have flexibility.

In summary, the learning evaluation indicators in project-based learning should be designed from four dimensions to create two types of evaluation indicators: mandatory indicators for supervision, and flexible indicators for encouragement based on compliance with fairness. **Figure 1** shows the composition of the evaluation indicator system.

### 3. Mandatory Indicators and Implementation Plan in Evaluation Standards

Project based learning is a type of self-directed learning with the goal of achieving projects. During this self-directed learning process, in this self-learning process, teachers should understand whether students have mastered the required level of knowledge, which is essential for developing comprehensive curriculum projects.



**Figure 1.** Composition of evaluation indicators.

Therefore, teachers need to supervise students to complete small projects for each knowledge point.

So how to urge students to complete the learning of those knowledge points? Suggest setting up a small comprehensive case for students to refer to in each knowledge category, and then assigning a small comprehensive exercise that students need to complete on their own, With the help of some platforms, such as Net disk and Rain Classroom at Tsinghua University, all small comprehensive exercises will be released at once, with a deadline given. Students can determine the progress and order of completing the exercises themselves, respecting personalized development. In order to balance fairness, students need to have an evaluation index to complete the exercises.

The total number of exercises is  $C$ , the score for a single exercise is  $E$ , The calculation expression is (1)

$$E = (100 - 10) / C \quad (1)$$

The reward score for submitting a single exercise in the top 60% is  $R$ , The calculation expression is (2)

$$R = 4 / C \quad (2)$$

All exercises submitted in the top 60% will receive a reward score of  $A$ , The calculation expression is (3)

$$A = 6 \quad (3)$$

Ranking for each practice submission is  $R_i$ , and all exercises submitted in the top 60% calculation method is  $F(R_i)$ , The calculation expression is (4)

$$F(R_i) = \sum R_i / C \quad (4)$$

The total score of practice is  $T$ , the calculation expression is (5).

$$T = \sum (E + R) \quad (5)$$

The final total score for the exercise is  $F$ , the calculation expression is (6).

$$F = T + A \quad (6)$$

Taking the 10 exercises that need to be submitted as an example, let's assume that A1 students in Group A have completed 10 exercises, each of which is in the top 60% of the class. B1 students in Group B have completed 9 exercises, 5 exercises being in the top 80%, 4 exercises are in the top 90%, and after a comprehensive evaluation, each exercise is in the top 90% of the class. The final score is shown in **Table 1**.

#### 4. Flexible Indicators and Implementation Plans in Evaluation Standards

Flexible indicators are mainly designed to respect the wishes of the majority of students, it is necessary to listen to students' ideas and perspectives, and in the process of implementing a comprehensive curriculum project, to exercise and improve leadership, planning, execution, communication, teamwork, and expression

**Table 1.** Example of mandatory evaluation indicators.

	assessment	Score	Score of A1 students in Group A	Score of B1 students in Group B
	a single exercise	10	90	81
	a single exercise in the top 60%	0.4	4	
	a single exercise in the top 70%	0.3		
Mandatory Evaluation Indicators	a single exercise in the top 80%	0.2		1.6
	a single exercise in the top 90%	0.1		0.4
	all exercises submitted in the top 60%	6	6	
	all exercises submitted in the top 70%	5		
	all exercises submitted in the top 80%	4		
	all exercises submitted in the top 90%	3		3
	The total score of practice	90 - 94	94	83
	The final total score	0 - 100	100	86

abilities. To ensure that there are no negative impacts during the learning process, evaluation indicators need to focus on the students' own strengths and efforts. The specific implementation method is shown in **Figure 2**.

In **Figure 2**, the flexible evaluation indicator consists of two parts: group score and individual reward score. The total score is 100 points, and the proportion is determined by students through discussion. Based on the completion of the project by the group, everyone scores and evaluates the group's score. The teacher sets reward points for individuals based on the course situation. **Table 2** shows an example of designing flexible evaluation indicators.

In the example course "Webpage design technology" in **Table 2**, students discussed and decided that the Mandatory evaluation index accounted for 40% and the flexible index accounted for 60%. In flexible indicators, the proportion of group project scores is 80%, and the proportion of reward scores is 20%. The proportion of project requirements is 50%, and the proportion of project implementation is 50%. Answering and questioning accounts for 30%, and coaching others accounts for 40%. In the actual implementation process, the scores of A1 students in Group A and B1 students in Group B are shown in **Table 1** and **Table 2**. So the final scores for A1 and B1 are calculated as follows.

A1's group score is X1, A1's reward score is X2, A1's flexible score is X3, A1's Mandatory evaluation score is F1, A1's Final score X, Their expressions are as follows.

$$X1 = 96 \times 50\% + 98 \times 50\% = 97$$

$$X2 = 90 \times 30\% + 60 \times 30\% + 70 \times 40\% = 27 + 18 + 28 = 73$$

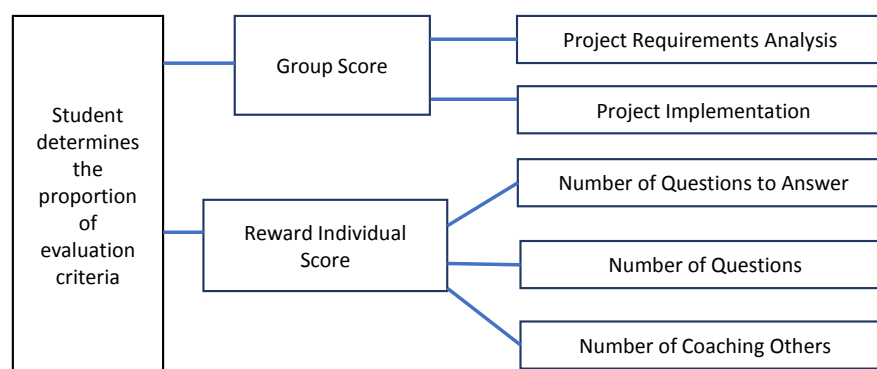
$$X3 = 97 \times 80\% + 73 \times 20\% = 92.2$$

$$X = F1 \times 40\% + X3 \times 60\% = 100 \times 40\% + 92.2 \times 60\% = 95.32$$

B1's group score is Y1, B1's reward score is Y2, B1's flexible score is Y3, B1's

**Table 2.** Example of flexible evaluation indicators.

Score Ratio	assessment	Scoring rules	A1 in Group A	B1 in Group B	
Flexible Evaluation Indicators	Group Score 80%	Project requirement analysis and evaluation (100 points), 50%	Rate and evaluate each other after explaining the project	96	94
		project implementation evaluation (100 points) 50%	Rate and evaluate each other after explaining the project	98	96
	Reward Points 20%	Number of questions to answer 30%	Maximum is 100 points, reward 10 points for answering a question	90	90
		Number of questions 30%	Maximum is 100 points, reward 10 points for asking a question	60	80
		Number of times coaching others 40%	Maximum is 100 points, reward 10 points Coaching 5 times	70	80

**Figure 2.** Composition of flexible evaluation indicators.

mandatory evaluation score is F2, B1's Final score Y, Their expressions are as follows.

$$Y1 = 94 \times 50\% + 96 \times 50\% = 95$$

$$Y2 = 90 \times 30\% + 80 \times 30\% + 80 \times 40\% = 27 + 24 + 32 = 83$$

$$Y3 = 95 \times 80\% + 83 \times 20\% = 92.6$$

$$Y = F2 \times 40\% + Y3 \times 60\% = 86 \times 40\% + 92.6 \times 60\% = 89.96$$

From the final scores of A1 and B1, it can be seen that the reward scores in the flexible evaluation indicators are conducive to encouraging positive and helpful classmates. In practical courses, students with high scores in mandatory evaluation generally score higher in flexible evaluation indicators.

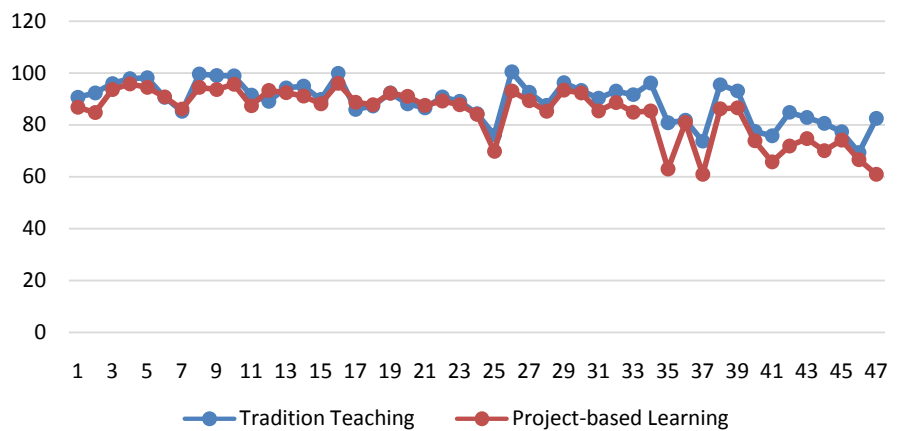
## 5. Comparing the Evaluation Results of Traditional Teaching and Project-Based Learning

This paper takes the course "Webpage design technology" as an example. In the traditional teaching process, the teacher evaluated homework, attendance, final exams, exercises, mutual guidance between students, and student lectures. According to the evaluation method of project-based learning, the evaluation indicators for this course have been designed as shown in **Table 3**.

**Table 3.** Evaluation indicators for project-based learning in webpage production technology.

Mandatory indicators	60% (Consistent with traditional teaching evaluations)	Number of assignments	Score per assignment	8 times	Total score 90	
		Reward points per time	Add up the reward points per time	60% reward 0.5, 70% reward 0.4, 80% reward 0.3, 90% reward 0.2	Total maximum 4 score	
		Comprehensive reward score	Add points based on the comprehensive ranking of all assignments	60% reward 6, 70% reward 5, 80% reward 4, 90% reward 3	Up to 6 score	
Flexibility indicators	40%	integrated project	80%	Practical exam scores	Up to 100 score	
		Number of coaching others	20%	50%	10 score 3 times	Up to 100 score
		Number of classes	50%	50%	10 score per time	Up to 100 score

### Score Comparison Chart



**Figure 3.** Calculated grades based on project-based learning evaluation indicators.

According to **Table 3**, the scores of each student were recalculated, the comparison between the evaluation results of project-based learning and traditional teaching is shown in **Figure 3**.

From **Figure 3**, it can be seen that the new scores obtained from project-based learning evaluation indicators are basically consistent with the scores obtained from traditional teaching under the same student’s original grade records. It demonstrates the feasibility of project-based learning evaluation indicators. Moreover, students see rewards throughout the entire evaluation index, which is conducive to positive feedback. The 35th, 37th, and 47th students with significant differences were in **Figure 3**. After investigation, it was found that the 35th and 37th students were due to low project scores, while the 47th student was due to not submitting their homework in their daily routine. Other students’ grades are all above 80. As this course is a professional foundation course in software technology, it is simple and students enjoy learning, so the overall score is relatively good.

## 6. Summary and Outlook

College students who have just entered the campus are full of vitality, eager for

knowledge, and full of expectations for the future. Adopting traditional educational methods is difficult to meet the needs of college students and is not conducive to guiding them forward. Project based learning places students in the main position. Students take themselves as the main body, supplemented by teachers, to explore various fields. The transformation of teaching methods requires corresponding changes in evaluation methods. This paper explores a set of incentive evaluation indicators that are easy to implement by combining mandatory and flexible indicators. Taking the specific course grades of “Web-page design technology” as an example for conversion, the experimental results show that the designed evaluation indicators are feasible and reasonable. This paper is just an introduction, hoping that more experts and scholars will conduct research and practice on the evaluation indicators of project-based learning. The next research direction is to design and implement system software for this evaluation function, which can reduce the workload of teachers.

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### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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