Construction of Evaluation Model of Dynamic Stratified Grade Point of Automobile Electrical System Diagnosis Course

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Abstract: The accurate evaluation of a course determines the quality of learning and is the basis for evaluating the students' academic achievements. This paper, on the theoretical basis of grade point, builds a dynamic stratified GPA (Grade Point Average) evaluation model for the course Automotive Electrical System Diagnosis, focuses on the whole process assessment and aims to stimulate the enthusiasm of learning to meet the demands of the training of social skilled talents.

Keywords: Grade point; Dynamic stratification; Model construction

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1. Introduction

The thought of "educating those who have deep education with deep knowledge, those who accept little education with shallow knowledge; developing their advantages through better means; showing respect for their self-esteem"[1] means to teach students in accordance with their aptitude. This educational concept raised by Confucius thousands of years ago is still approved to date. All kinds of schools keep exploring and studying their own mode of teaching management The "credit system" has been used by major institutions of higher learning as soon as it appears[2-3]. This system fully respects and satisfies the individualized demand of educators, and it is the only way to realize the education democracy and the equality of education. And the flexible learning system not only expands the width of learning, but also increases the dimension of learning. It plays an important role in improving the students' learning enthusiasm and initiative, and really "teach students in accordance with their aptitude".

2. Meaning of Credit System

The "credit system", as the name implies, takes credit as a measure of students' examination and graduation. For each course, the credit is set according to the number of credit hours. Students can choose the courses freely, 60-point or above equals pass, yet 60-point or below means fail. Credits can be obtained as long as the students pass the exam, and the credits accumulated to a certain amount mean the student can leave the school. According to the characteristics of the "credit system", we can see that as long as students pass the exam, regardless of their grades, they will get the same credit without difference.

3. Deficiency of Credit System

In fact, the degree of difficulty of different courses is different, and even the complexity of different projects is different. Thus, the students need to pay consciousness and efforts varying from others. And the gap between 100 points and 60 points indicate that the teacher's teaching

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effects and students' mastery of knowledge are also different. The credit system objectively reflects the "quantity" of the students' learning, which cannot reflect the "quality" of the students' learning. The deficiency[4-6] of the credit system is mainly embodied in the following aspects:

3.1 Difficulties in Ensuring Learning Systematicness and Completeness

Under the "credit system" management system, students can freely choose courses, or even select courses cross-specialty or inter-discipline. The lack of systematicness and completeness in the learning process as well as learning contents will be a barrier to the cultivation of students' systematic working ability.

3.2 Appearance of Phenomenon of Simply Pursuing Credits

Students can get credit as long as they pass the exam. Some students don't care what to learn and how much the exam results are. "Long live the pass" is the words of some students keep saying. The credit is available no matter with 60 or 100 points, the difference in credit decreases, and the standard of learning decreases. Students are simply pursuing credits for the purpose of obtaining the qualifications of graduation, paying no attention to the learning process and the mastery degree of knowledge capacity.

3.3 Failure in Reflecting Students' Learning Quality Due to Small Binding Force on the Learning Process

The ultimate aim of the vocational colleges is to cultivate the high and middle skilled personnel suitable for the needs of the enterprises. Such personnel not only need to grasp a solid theoretical knowledge, but also have skillful operation skills. And the training of skills is gradually developed in the process rather than mastered by "cramming before the exam". The credit system lacks of binding force on the learning process, thus it cannot truly reflect the quality of students' learning.

4. Construction of Dynamic Evaluation Model

How to strengthen the process of assessment, to integrate the quantity with quality of learning and to make up for the insufficiency of the management mode of the credit system are the problems to be solved urgently in colleges and universities. Reference[4] notes that Tsinghua University has established a strict attendance system to punish against whom are absent from school. In Northwestern Polytechnical University, no credit would give to the one who is absent from 1/3 of classes or lacks 1/3 of homework and experiment report. But these measures cannot fundamentally solve the problem and achieve "quality improvement". The "grade point system" is derived from the credit system, linking the point of achievement to the credit. This kind of teaching management system can reflect the learning quality of each course of the students, the quality of the academic year and the total grade of graduation. The method is to convert the percentage achievement to the grade point, and formula [7] is as follows: Grade point = Credit * Grade point; accumulate the grade points of all subjects, and then average the accumulated grade points to gain GPA to reflect students' learning quality. Although the method distinguishes between good and poor results. However, most of the cases are still based on the final examination results, and there are some contingencies and inaccuracy.

The accurate evaluation of a course determines the quality of learning and is the basis for evaluating students' academic achievements. This paper, based on the course of Automotive Electrical System Fault Diagnosis and Repair, studies on how to combine credits and grade points in the working process and integrates stratified teaching, stratified assessment, performance points with grade points to establish an evaluation model of dynamic stratification GPA for a single course.

4.1 Evaluation Basis of Credit System

Automotive Electrical System Fault Diagnosis and Repair is a core course of automotive major in Higher Vocational Education with a total of 260 credit hours. Wherein, every 16 credit hours equal to 1 credit, and the total credits are 16.25. In the meantime, the integrated theory-practice teaching model is adopted. 34 typical tasks will be extracted from the course according to the curriculum standards. According to the proportion of the credit hours used for each task, the credits to be obtained are marked as Ki, as is shown in Table 1.

4.2 Transformation of Credits and Grade Points

The typical work task is assessed by the percentage system, and the assessment method is as shown in Table 2. It needs to particularly note that the integrated theory-practice teaching model emphasizes the combination of theory and practice, but in the actual process, more attention is paid to the cultivation of students' skills. Under the influence of "sufficient theory", the content of the theory is gradually weakened. But completing the automotive electrical troubleshooting requires a solid theoretical foundation and analytical ability. In order to better supervise the students to complete the theoretical study, it is required to complete the assessment of the knowledge of the previous lesson before completing each training project. The one who failed to pass the test is not allowed to participate in

Table 1. Typical Work Task

Typical work task	Credit hour	Credit	Typical work task	Credit hour	Credit
1-1 Understanding of batteries	2	0.125	4-1 Structure of the starter	4	0.25
1-2 Care and maintenance of batteries	8	0.5	4-2 Fault diagnosis and elimination of the starter	6	0.5
1-3 Fault diagnosis of batteries	8	0.5	4-3 Fault diagnosis and elimination of the start-up system	8	0.5
2-1 Use of electrical/electronic circuit diagnostic instruments	10	0.625	4-4 Structure and principle of the ignition system	4	0.375
			4-5 Fault diagnosis of single cylinder fire cutoff	8	0.625
2-2 Inspection and adjustment of automobile instruments	8	0.5	5-1 Fault diagnosis and elimination of central control door lock system	16	1
3-1 Structure and principle of the lighting system	4	0.25			
3-2 Regulation of the headlights	4	0.25	5-2 Fault diagnosis and elimination of electric windshield wiper system	16	1
3-3 Diagnosis and elimination of fault in lighting system	12	0.75			
3-4 Structure and function of the signal system	12	0.75	5-3 Fault diagnosis and elimination of electric power window system	16	1
3-5 Fault diagnosis and elimination of signal system	8	0.5	5-4 Fault diagnosis and elimination of electric seat system	16	1
3-6 Structure and principle of automobile instrument system	4	0.25	6-1 Structure and function of electrical components	6	0.375
3-7 Fault diagnosis and elimination of instrument system	8	0.5	6-2 Reading of the circuit diagrams	10	0.625
3-8 Structure of the generator	4	0.25	6-3 Engine computer fault diagnosis strategy	4	0.25
3-9 Fault diagnosis and elimination of generator	8	0.5	6-4 Basic principle of fault diagnosis of control unit circuit	4	0.25
3-10 Fault diagnosis and elimination of power system	8	0.5	6-1 Control unit work flow	8	0.5
			6-2 Initialization of control unit	6	0.375
			6-3 Physical principle of air conditioning system	4	0.25
			6-4 Structure and principle of air conditioning system	6	0.375
			7-1 Fault diagnosis and elimination of air conditioning system	8	0.5
			7-2 Care and maintenance of air conditioning system	8	0.5

Table 2. Single Work Task Evaluation Form (Percentage System)

Student name:	Date	Score	Self - evaluation	Group evaluation	Teacher evaluation
Project name	Evaluation contents				
Theoretical knowledge	Contents of class note	Precondition			
Professional quality 40%	Dressing	5 points			
	Safety awareness, sense of responsibility	8 points			
	Enthusiasm in participating teaching activities	10 points			
	Team cooperation ability	10 points			
	On-site 6S standards	7 points			
Professional ability 60%	Professional knowledge query ability	10 points			
	Equipment operation standards	10 points			
	Fault analysis method	15 points			
	Fault diagnosis process	15 points			
	Fault repair process	10 points			
Total					
General comment	Self-evaluation (20%) + mutual evaluation (20%) + teacher evaluation (69%)			Overall results	

training projects. After the trial implementation for two semesters, the results prove that the learning effect is good.

In the context of the credit system, the grade point is introduced as a method to evaluate the students' learning quality in order to reflect the differences of students' academic achievements more truly. According to statistics, 90% colleges and universities in the United States adopt 4-grade scoring system to calculate the grade points. According to the study on reference[8], we can know that the proportion of students who scored higher scores and lower scores in the actual examination process is relatively small. In order to make students' performance follow normal distribution, the percentage achievement will be converted to grade points according to Table 3, and be marked as X_i.

Table 3. Interconversion of Percentage Achievements and Grade Points

Score	>85	84-80	79-70	69-60	59-50	<50
Grade point	4	3.5	3	2	1	0

4.3 GPA

The grade point for a single task is equal to that of the work task multiplied the grade point, that is: f_i

$$f_i = K_i \times X_i \ ; \tag{1}$$

The total grade point earned for all tasks of the course will be recorded as. T_i Then:

$$T_i = \sum f_i = \sum_{i=1}^{n} X_i K_i \tag{2}$$

GPA is a measure of the effective learning of students and reflects the overall quality of students' learning. The method is fair, reasonable and comparable.

$$P = \frac{T_i}{\sum_{i=1}^{n} K_i} = \frac{\sum_{i=1}^{n} X_i K_i}{\sum_{i=1}^{n} K_i} \tag{3}$$

Take the achievements a student who completed all the work tasks as an example. The score of the student in 15 tasks is respectively: 82, 79, 90, 81, 75, 78, 65, 83, 67, 84, 78, 92, 75, 84 and 97. Use Table 3 to convert the percentage achievements of each project to grade points, and then calculate GPA using formulas (1) - (3) (see Figure 1). It can be seen that the use of single task to calculate GPA can better test the learning process, reflecting the students' learning quality, and the calculation results have some comparability.

After reviewing the overall performance statistics of 32 students in the class, it can be found that: grade point of

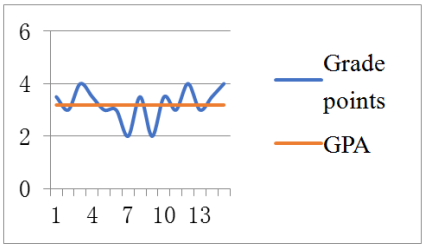

Figure 1 Students' Semester Score Evaluation Results

4 or above accounted for 10%, grade point between 4-3.5 accounted for 5%, that in the range of 3.5-3 accounted for 39.4%, that between 3-2 28.9 %, that in between 2-1 10%, and that between 1-0 5%. This shows that most of the students' grade points are between 2-3.5, and the number of the highest point and the lowest point is relatively small. Although the result is in the normal distribution, it also shows that most of the students' performance are general. It is still a key problem to be solved at present on how to strengthen the effectiveness of the classroom, stimulate the students' interest in learning, fully excavate the students' potential and improve the effectiveness of the class.

4.4 Dynamic Stratified GPA

The students in vocational colleges have a poor learning foundation, and the students' learning ability and acceptance ability are uneven. Automotive Electrical and Circuit System Fault Diagnosis and Repair involves in electrical and electronics, circuit analysis and other aspects of knowledge and is more difficult to learn, thus many students have preconceived ideas of "I can't" and even produce resistance. In view of the students' learning situation, to better stimulate students' autonomy in learning, each task should be assessed at three levels according to the difficulty degree. The difficulty level will be set to A if it involves complex automotive circuit fault and content. Level B if it involves less complicated content and can be solved through thinking a bit. Level C if it involves the content of basic knowledge and disassembly measurement. In addition, the degree of difficulty g was introduced, as is shown in Table 4.

Table 4 Corresponding Difficulty Coefficient at Different Level

Grade point\g\difficulty level	A	B	C
4	1.3	1.2	1.1
3.5	1.2	1.15	1.05
3	1.15	1.1	1
2	1.1	1.05	0.95
1	1.05	1	0.9
0			

Students are free to choose one of the three levels A, B and C, to calculate according to the completion of the task, then multiply by the corresponding coefficient, and finally we can get the task grade points. As is shown in formula (4):

$f_i = g_{wi} \times K_i \times X_i$, represents any one of the three levels of A, B, and C. w (4)

Thus, we can deduce:

$$T_i = \sum f_i = \sum_{i=1}^{n} g_{\dot{w}} K_i X_i \quad (5)$$

GPA in the stratified condition:

$$P = \frac{T_i}{\sum_{i=1}^{n} K_i} = \frac{\sum_{i=1}^{n} g_{\dot{w}} K_i X_i}{\sum_{i=1}^{n} K_i} \quad (6)$$

The cases of grade points greater than 4 or less than 1 will occur while applying this method to calculate the student's average grade point, which is exactly the highlight of the method. Assuming that a student always select A task, and each task is more than 90 points, then the grade point would be 4 after conversion, to multiply by the difficulty coefficient, so the grade point of the single task would be 5.2. Finally, his final semester grade point is 5.2. $g_{Ai}(1.3)$ The extra 1.2 grade points can be given as a reward to be accumulated and exchanged for other credits. The flexible credit conversion system only stimulates students' motivation but also reduces students' learning burden.

4.5 Obvious Advantages of GPA under Dynamic Stratified Assessment

This method after a year trial operation in this course, based on GPA under dynamic stratified assessment, has obvious advantages.

1) Stimulate students to desire to advance. For students in puberty, driven by aggression and self-esteem, different chemical reactions will be caused if setting tasks to be different levels. Students with good grades will gather together, and compete with each other, funny. The average students will have pressure seeing their peers doing well. They will be eager to catch up. For students with poor learning ability, they will not be outdated as long as they are willing to learn and reach overall optimization.

2) Fully mobilize the enthusiasm of students, not only to enable students to take full advantage of their own potential, but also to enable students with poor learning ability to master the basic theory and skills and be interested in the course at the same time, avoid them "giving up themselves". Therefore, it needs to teach according to

students' aptitude.

3) Despite the increased workload of teachers, the teaching effectiveness have been greatly improved. The teacher should prepare three different levels of theoretical knowledge and assessment standards for the same task according to the situation of students. Take the work task of "circuit fault diagnosis and elimination of power system" as an example: Students at the simple level are required to get familiar with the composition and function of the circuit of the power system, the working principle and the method of disassembly of each component. Students at the general level are required to be able to read the circuit of the power system, and detect and repair the simple fault. Students at higher difficulty level are required to be capable of reading the complex models of power system circuit, and carry out analysis, detection and maintenance of complex fault. Despite the increased workload of teachers, the teaching effectiveness have been greatly improved. According to the statistics, the overall performance of the class was increased by 13%. Learning is no longer boring and more like "upgrading in the game and fighting against the monsters", full of fun.

5. Conclusion

It is of great significance to explore an evaluation mechanism different from the traditional credit scoring system, to make up for the weakening of the process assessment under the credit system management model, and to improve students' learning quality and classroom teaching effect. The construction of the dynamic stratified GPA evaluation mechanism of a single course, focuses on the whole process assessment, and plays an important role in stimulating the enthusiasm of learning and training skilled talents meeting the society demands. Of course, the change of evaluation mode is accompanied by curriculum reform. In order to fully tap the potential of students and mobilize their enthusiasm as well as improve teaching effect, we should actively explore more diversified curriculum evaluation mechanism.

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