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RESEARCH ARTICLE

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Innovation and Practice of Formative Evaluation of Courses Based on Student Teams Achievement Division Method

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Abstract: Student Teams Achievement Division (STAD) is a form of educational organization designed by Professor Slavin of Johnson University in the United States based on the theory of learning motivation. (Slavin, 2011) It is an effective teaching method that has been experimentally validated. It is especially suitable for students with large basic differences and difficult course teaching. (Zhou, 2019) (Khan)This paper takes the "Troubleshooting and Troubleshooting" course of our school as an example and adopts STAD to make bold reforms to the formative examination mode of the course, which has obtained certain results.

Keywords: Student Teams Achievement Division, vehicle fault diagnosis, and troubleshooting course, formative assessment, Innovation

1. Introduction

One of the most widely used collaborative learning methods is Student Teams Achievement Division (STAD) created by Professor Slavin at Hopkins University. The STAD Cooperative Learning Approach effectively eliminates the disadvantages of traditional teaching models and benefits students at all levels. (He, & Shao, 2005) (Zheng, 2016)

2. The Overall Thought of Formative Assessment Based on STAD

Student Teams Achievement Division Method (STAD) is used to teach the group, and the Group Achievement is used to replace individual achievement with Progress Achievement. In the end, the results of each group were sorted, and the standard scores were taken as the formative results of all students in the group.(An, 2020) (Zhang ,2018) To replace individual results with group results and cultivate students' teamwork spirit; By replacing the actual results with the progress grades, the student's interest in learning is aroused and the effectiveness of the grades is ensured. Take the standard score as the formative appraisal result, stimulate the student's competitive consciousness, and ensure the distinction of grades; Formative appraisal covers three stages: pre-curricular study, course teaching, and individual personnel practice, ensuring the credibility of formative appraisal(Zhang, 2022) (Wu, 2022).

3. Specific practices and practice

The teaching of vehicle fault diagnosis and troubleshooting course is mainly divided into three stages: pre-course pre-study, group troubleshooting, and individual personnel troubleshooting. The pre-course pre-study stage consists of students pre-study the pre-study resources recommended by the teacher and answering the pre-study tasks set by the teacher to lay the foundation for group troubleshooting. The group troubleshooting phase mainly adopts the way of practical training in groups, with the designated group troubleshooting under the guidance of the teacher to provide support for

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single-personnel troubleshooting. Single personnel practical stage using two vehicles, under the guidance of the teacher by other students for the two vehicles set the same fault, take 1v1, group PK mode of training. The formative assessment reform based on STAD grouping covers three phases: pre-course preparation, group troubleshooting, and single-person practical operation. It has been practiced in two classes of 2021 students, and the pilot practice is as follows.

3.1 Formative assessment in the pre-study stage

Before teaching each fault task, the teacher pre-arranged the fault task related to the pre-study questions, mainly subjective questions, from the group answer questions to the teacher for correction, scores in percent, the end of the course will be all the scores are added up to get the score of the group, according to the score of the group were 5, 4, 3, 2 points, as the group of all the people of the formative assessment scores in this stage.

Take the pilot class 2021, students, 1, and 2 classes as an example (a total of 16 people divided into four groups), there are two after-school assignments, respectively, in the "electronically controlled engine does not start troubleshooting internship" and "lighting troubleshooting" before.

Specific topics are:

(1) What are each of the engine sensors and actuators? (10 points)

(2) What are the fuses and relays that affect the power supply to the engine ECU? (10 points)

(3) What engine sensors and actuators failures can cause a stalling fault? (20 points)

(4) What is the direction of the fuel line? (10 points)

(5) What are the causes of one-sided low beams not coming on? (10 points)

(6) What are some reasons why both low and high beams do not come on? (20 points)

(7) What are the reasons for high beams not coming on? (20 points)

The scores are set considering the difficulty of the questions, of which the first and third questions are objective questions that can be answered directly in the reference materials. The others are subjective questions, which require students to think and discuss, relatively speaking, the 3rd, 6th, and 7th are more difficult and therefore set higher scores, the scores of the pilot 1 and 2 classes of the first district team of students in the class of 2021 are shown in **Table 1**.

Table 1 :List of pre-preparation scores in the pilot classes

group	Group1	Group2	Group3	Group4
Actual score	76	68	57	71
Conversion score	5	3	2	4

3.2 Formative assessment in the group troubleshooting stage

The formative assessment score in the group troubleshooting stage is mainly composed of the following parts. First, through the theoretical prompts in the questioning session to each group for scoring (according to the difficulty of the problem, respectively, 4, 3, 2 points, according to the answer to the situation as appropriate to give points) and counted in the group scores. The second is based on the discussion to the group for scoring (according to the discussion of the difficulty of the problem, were set at 5, 4, 3 points, according to the discussion of the situation as appropriate to each group to add points); third is based on the group troubleshooting scoring (each group to complete the four faults, respectively, the engine does not start faults, the clutch is not completely disengaged faults (AMT automatic transmission faults), lighting faults, the central gas filling and deflating system failure (CAN communication faults), scores (CAN communication fault), scoring according to the ABCD four-level system, after each test to update the basic score, to ensure the fairness of the scoring, the teacher on the

spot to give the score, recognized by all the students can be recorded. The scores are converted to team grades according to **Table 2** (initial scores are calculated as B). Before the end of the course, these three grades will be added up, and 10,8,7,6 points will be given to each team according to their scores as the formative assessment scores of all the people in the group at this stage. The scores of pilot 1 and 2 classes are shown in **Table 3**.

Table 2 :Conversion table for grades

Last score / Conversion score / score	A	B	C	D
A	10	15	20	25
B	0	5	10	15
C	-15	-10	-5	0
D	-20	-15	-10	-5

Table 3 Troubleshooting scores for the pilot class groups are as follows:

group	Group1	Group2	Group3	Group4
Actual score	B、B、A、A	A、A、A、A	A、B、B、A	A、A、A、A
Conversion score	5+5+15+10	15+10+10+10	15+0+5+15	15+10+10+10
Answer score	12	10	11	9
Actual total score	47	55	46	53
Conversion total score	7	10	6	8

3.3 Formative assessment of individual personnel troubleshooting stage

Individual personnel troubleshooting training stage, the use of two vehicles, under the guidance of the teacher by other students for the two vehicles, set the same fault, to take 1v1, group PK mode of training. After each training session, four groups will evaluate the two PK participants respectively. The teacher refers to the evaluation results of the four groups to make the final evaluation of the students. Generally speaking, the troubleshooting should not exceed 10 minutes, if the troubleshooting is not done in 10 minutes, the troubleshooting will be stopped and the evaluation will be "C" or below. Teachers and students observe the troubleshooting situation in real-time through the wireless camera and stop the illegal or unsafe operation immediately to ensure safety. If the malfunction is caused by an illegal operation, the evaluation will be "D". At the end of the lesson, all the people in each group were converted to scores according to Table 1 (individual basic scores were based on the results of the introductory course and updated according to the results of each evaluation) and the average score of each group was calculated (average score = the sum of the scores of all the people in the group for each conversion/number of people), and after conversion, the scores were sorted. Assign values according to

Table 4 as the formative assessment scores of all people in the group at this stage.

Table 4: Individual personnel troubleshooting stage score assignment table

C、D ratio / Assigned score / Team ranking	Within 10% (inclusive)	10%—15% (inclusive)	15-20% (inclusive)	More than 20%
1	15	14	13	12
2	13	12	11	10
3	12	11	10	9
4	11	10	9	8

Taking the experimental class of 2021 students as an example, its single troubleshooting course is the engine not starting failure and headlight failure, and its individual scores and group conversion scores are shown in **Table 5.**

Table 5 :Troubleshooting Scores for Individual Personnel in Pilot Classes

group	serial number	Initial score	first time grade	Second time grade	Conversion score	group score	accounting score
1	e 1	A	B (0)	A (15)	15	70	15
	2	B	B (5)	A (15)	20		
	3	C	B (10)	B (5)	15		
	4	A	A (10)	A (10)	20		
2	5	B	A (15)	B (0)	15	65	12
	6	A	A (10)	A (10)	20		
	7	B	B (5)	A (15)	20		
	8	B	B (5)	B (5)	10		
3	9	B	C(-10)	B (10)	0	65	11
	10	A	A (10)	A (10)	20		
	11	B	B (5)	A (15)	20		
	12	C	B (10)	A (15)	25		
4	13	C	B (10)	A (15)	25	70	14
	14	B	C(-10)	A (20)	10		
	15	C	B (10)	A (15)	25		
	16	B	B (5)	B (5)	10		

3.4 Achievement Analysis

The experimental class formative assessment scores and summative assessment scores are shown in **Table 6**. From the table, it can be seen that the correlation between the average score of the usual grades and the average score of the summative practical assessment is relatively high, indicating that this formative assessment method can more accurately respond to the student's learning situation, in addition to using this grouping method of the average score of the practical assessment is 83.31, and the average score of the other classes is 81.25, which indicates that the use of STAD grouping is of some help to the improvement of the students' practical scores.

Table 6: List of experimental class group results

group	Group1	Group2	Group3	Group4
Score in the preview phase	5	3	2	4
Score in the Troubleshooting phase (group)	7	10	6	8
Score in the Troubleshooting phas (Individual personnel)	15	12	11	14
Formative assessment results	27	25	19	26
Practice test average score	88.25	83.5	78.5	83

4. Conclusion

The formative assessment reform based on "STAD" has been piloted in the "Vehicle Troubleshooting and Diagnosis" course for two classes of students in the class of 2021, and through the pilot situation, tusual grades given by this assessment method cover the whole process of teaching and learning, and the final practical grades can be more accurate by comparing the results. By comparing the final practical grades, it can accurately reflect the student's learning situation, and at the same time, it has a certain promotion effect on the students' learning. However, there are still some problems in this assessment program that need to be improved, for example, in the formative assessment of the pre-preparation stage, due to the small number of points, it is not scientific enough to be assigned according to the ranking (the last one only gets 2 points, which is converted to 40 points in the percentage system, which is low, and the first one gets 5 points, which is 100 points, which is high). At the same time, due to the small number of pilots, its effectiveness needs to be further verified.

Conflict of Interest

The authors declare that they have no conflicts of interest to this work.

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