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Application of Hierarchical and Progressive Teaching Methods in Gastroscopy Simulation Training Education of Emergency Department Physicians

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Abstract: The purpose of this study is to explore the application of hierarchical progressive teaching methods in emergency department physicians. Traditional medical education methods usually adopt a unified teaching plan, which cannot meet the learning needs of different students. Therefore, this study introduced the hierarchical and progressive teaching method and developed a personalized learning plan according to the gastroscopy skill level and needs of physicians. Methods through comparative research, including assessing trainees' skill level, group learning, implementing personalized education, providing real-time feedback, and regular assessment. The results showed that the students who applied the hierarchical progressive teaching method showed a significant improvement in the gastroscopy skill assessment. They were more actively involved in classroom activities, and their learning satisfaction was improved significantly. Compared with traditional teaching methods, the hierarchical progressive teaching method has higher educational efficiency, enabling students to master skills more quickly. Furthermore, standardized assessment tools make it easier to measure trainees' skill levels. Therefore, this study concluded that the hierarchical progressive approach is an effective educational strategy that can be used to improve the gastroscopy skills and medical quality of ED physicians. Future studies could further explore how to further improve and optimize this educational approach.

Keywords: Emergency department doctor; Gastroscopy simulation practice education; Hierarchical and progressive teaching method; Education effect

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1. Introduction

In the process of treating all kinds of acute and critical patients, emergency department doctors need to make rapid and accurate diagnoses and take timely and effective treatment measures. Gastroscopy is one of the important means to diagnose digestive tract diseases, which is of great significance in clarifying the cause, guiding the treatment, and judging the prognosis. However, due to the complex and changeable conditions of

patients in the emergency environment, physicians need to make accurate judgments in a very short time, which puts forward extremely high requirements on the professional skills and adaptability of emergency department physicians [1]. This requires learning gastroscopy through the emergency department physician gastroscope simulation training education system to improve the professional skills of the emergency department physicians.

Gastroscopic simulation practice education for emergency department doctors refers to the teaching method of gastroscopy through practical operation in a simulated environment [2]. Its main characteristic is practical operation, emphasizing skill training and ability improvement [3–4]. In the teaching process, teachers will design different practical training projects and scenarios according to the requirements of the teaching syllabus and the learning progress of the students, to improve the students' practical operation ability and diagnosis and treatment level [5].

At present, the simulated practice education of gastroscopy for emergency department doctors in China is mainly carried out through the simulated practice classroom. Training classrooms are usually equipped with professional gastroscope simulators and related equipment to meet the operational needs of students [6–7]. In the actual teaching, the teachers will make detailed practical training plans and teaching contents according to the requirements of the teaching syllabus and combined with the actual situation of the students.

At present, the education of emergency department doctors in China is not perfect and there are some problems. On the one hand, traditional teaching methods often pay too much attention to the indoctrination of theoretical knowledge and ignore the training of practical operation skills, which leads to students often facing difficulties in practical operation. On the other hand, the existing simulation training equipment and space are limited, which cannot meet the training needs of all students [8]. These problems have seriously affected the improvement of their practice ability, diagnosis, and treatment level.

However, due to various reasons, there are still some problems in the current gastroscopy simulation training education for emergency department physicians. First of all, the quality and performance of the training equipment are uneven, and the operation sense and reality of some simulation equipment are not high, which affects the learning effect of students. Secondly, the number of practical training classrooms is limited, which cannot meet the learning needs of all students. Thirdly, some teachers' understanding and application of the hierarchical and progressive teaching method are not deep enough, which leads to a poor teaching effect. Finally, there are also some problems in the time arrangement of practical training courses and the design of teaching content, which cannot meet the learning needs of students. Given the above problems, this study analyzed them from the following aspects.

Equipment problems: The current simulation equipment cannot provide a real operation experience, which has a certain impact on the students' skill training [9]. In addition, there are also some problems in the maintenance and management of the equipment, such as equipment aging, damage, and so on.

Teaching resources: Due to the limited number of practical training classrooms, it cannot meet the learning needs of all students [10]. In addition, some teachers' understanding and application of the hierarchical and progressive teaching method are not deep enough, which leads to a poor teaching effect.

Teaching methods: Traditional teaching methods pay too much attention to the indoctrination of theoretical knowledge, and ignore the training of practical operation skills. In addition, there are also some problems in the selection and design of teaching methods, such as the lack of pertinence and flexibility [11].

The above problems are only superficial phenomena, which reflect some deep-seated problems in the simulation training education of gastroscopy in the emergency department. First of all, the teaching mode is still in the traditional theoretical teaching stage, without making full use of modern educational technology, such as multimedia, networks, and so on, to improve the teaching effect. Secondly, the teaching evaluation system is

not perfect enough, and the teachers pay too much attention to the assessment of theoretical knowledge, while ignoring the evaluation of practical operation skills [12]. Thirdly, the quality of the teachers still needs to be improved, and some teachers' teaching ideas and methods are still relatively backward, and cannot adapt to the new teaching mode. Finally, the management system also needs to be further improved to ensure the quality and effect of practical training and education.

Therefore, this study aims to explore the application of an effective teaching method — the hierarchical progressive teaching method in the practice education of emergency department physicians. Through the theoretical analysis, practical application, and effect evaluation of the hierarchical progressive teaching method, it is expected to provide theoretical support and practical reference for improving the current situation of gastroscopy simulation training education for emergency department doctors and improving the diagnosis and treatment skills and service level of doctors [7, 13–15].

2. Contrastive Study

2.1. The theoretical basis of the traditional teaching method

The traditional teaching method is usually teacher-centered, using a "one-size-fits-all" approach [16]. This teaching method ignores the individual differences of students, which often leads some students to keep up with the teaching progress, while others feel bored and unmotivated. In addition, traditional teaching methods often pay too much attention to the indoctrination of theoretical knowledge, And ignore the training of practical operational skills [12, 17–18].

2.2. Methods of traditional teaching methods

Thirty emergency department physicians aged between 25–40 years old from December 2020 to December 2021 were selected as the study subjects. Inclusion criteria: (1) age between 25 and 40 years old; (2) emergency department resident or attending physician; (3) have not studied gastroscopy; (4) by department arrangement or independent registration. Using traditional teaching method: First, introduce the basic knowledge of gastroscopy through a theoretical explanation for about one week, then conduct a theoretical assessment (above 80 points means passing), after passing the next stage of practice; then use the model demonstration operation; then students group simulation practice; finally, evaluate students every month (above 80 points means passing) until pass.

2.3. Effect of the traditional teaching method

The effect of the traditional teaching method is shown in **Table 1** as follows.

2.4. The theoretical basis of the hierarchical and progressive teaching method

The hierarchical and progressive teaching method is a student-centered teaching mode, and its core concept is "teaching students according to their aptitude" [19]. According to the theory, each student's learning ability, learning style, and learning speed are different. Therefore, teachers should adopt different teaching methods and strategies according to these differences among the students to improve the teaching effect [20]. Specifically, the hierarchical progressive approach includes the following steps: First, the students are assessed to determine their learning level and needs; second, the students are divided into different levels or groups according to their ability level; and then, the teaching content and methods are designed for each level or group [21]; Finally, adjust and improve the teaching methods and strategies through repeated practice and feedback.

Table 1. The effect of the traditional teaching method

Number	Age	Theoretical assessment results	Gastroscopy skill assessment results in the first month	Results of gastroscopy skill assessment in the second month	The results of the third month	Time (month)	Post-class evaluation (1. Interested; 2. Not interested)
1	32	80	61	80		2	1
2	30	82	60	81		2	2
3	35	80	54	79	81	3	2
4	29	86	70	90		2	1
5	27	88	58	85		2	1
6	30	90	64	81		2	1
7	31	86	88			1	1
8	34	88	67	80		2	1
9	25	80	68	82		2	1
10	32	86	66	86		2	1
11	40	90	80			1	1
12	38	86	69	82		2	1
13	25	80	66	84		2	1
14	39	80	69			2	1
15	37	86	80			1	1
16	27	82	60	76	88	3	2
17	30	84	76	88		2	1
18	32	84	76	90		2	1
19	36	88	80			1	1
20	40	86	65	84		2	1
21	32	90	64	88		2	1
22	33	94	67	87		2	1
23	34	84	69	89		2	2
24	35	82	70	90		2	1
25	38	80	66	84		2	1
26	39	80	61	82		2	1
27	40	80	62	81		2	2
28	28	80	64	87		2	1
29	29	82	68	88		2	1
30	26	84	72	89		2	1

2.5. The steps and methods of gastroscopy simulation training education for emergency department physicians by applying the hierarchical and progressive teaching method

Thirty emergency department physicians aged 25–40 years old between May 2, 2023 and October 2023 were selected as study subjects. Inclusion criteria: (1) age between 25 and 40 years old; (2) emergency department resident or attending physician; (3) have not studied gastroscopy; (4) by department arrangement or independent registration. The hierarchical and progressive teaching method is adopted to teach gastroscopy skills through

gastroscopy simulation practical training, which mainly includes the following steps.

First of all, teachers need to understand the student's learning ability and technical level through observation and testing, then conduct theoretical tests and assessments, and then stratify according to the test results [22]. Generally speaking, students can be divided into three levels: primary, intermediate, and advanced. Primary-level students first supplement theoretical knowledge, then perform basic operation training, such as gastric tube insertion and extraction; intermediate-level students can perform some complex operations, such as gastroscopy and treatment; advanced-level students can perform more advanced operations, such as surgery, for about three days. After the early basic teaching, the theoretical knowledge assessment (more than 80 points means passing), until the students pass the assessment before the next teaching.

Secondly, the teachers need to design different practical training contents and methods for the students at each level. For example, for primary-level students, teachers can adopt intuitive and vivid teaching methods, such as physical demonstration, animation demonstration, and so on [23]; For intermediate-level students, teachers can adopt more complex teaching methods, such as problem-solving and discussion; for advanced students, teachers can adopt more advanced and more complex teaching methods, such as research learning, project learning, and so on [24]. The process took about four days.

Finally, teachers need to adjust and improve the teaching methods and strategies through repeated practice and feedback. For example, teachers can observe the actual operation of the students, understand their mastery degree and existing problems, and then provide targeted guidance and help [25]. The process is about a week to three weeks. At the same time, teachers can also understand the learning progress and effect of students through regular testing and evaluation, and then adjust and improve in time. Pass the assessment by the students (80 points or above means passing). The assessment is shown in **Table 2** below.

Table 2. The assessment results for the hierarchical and progressive teaching method

Number	Age	Initial interest in gastroscopy (1. Want to learn independently; 2. Department arrangement)	Theoretical achievement before the study	Theoretical results after the study	Practice results	Post-class evaluation (1. Interested; 2. Not interested)	Time (month)
1	25	1	60	90	90	1	0.5
2	32	1	70	100	96	1	0.5
3	35	2	60	80	86	1	0.5
4	40	2	50	80	84	1	1
5	39	1	60	90	92	1	1
6	37	1	60	100	94	1	0.5
7	25	2	60	80	88	1	0.5
8	40	1	60	90	87	1	0.5
9	39	1	70	100	90	1	0.5
10	35	1	60	80	80	1	0.5
11	36	2	70	90	92	1	0.5
12	37	1	60	80	88	1	0.5
13	28	2	60	80	86	1	0.5
14	29	2	60	80	87	1	1
15	30	1	60	90	89	1	0.5
16	31	2	60	90	90	1	0.5

Table 2 (Continued)

Number	Age	Initial interest in gastroscopy (1. Want to learn independently; 2. Department arrangement)	Theoretical achievement before the study	Theoretical results after the study	Practice results	Post-class evaluation (1. Interested; 2. Not interested)	Time (month)
17	34	2	70	90	83	1	0.5
18	36	1	80	100	85	1	0.5
19	37	1	70	100	88	1	0.5
20	25	1	60	80	86	1	1
21	27	2	70	100	94	1	0.5
22	28	1	60	90	86	1	0.5
23	26	2	70	100	87	1	0.5
24	32	1	70	90	89	1	1
25	33	1	70	90	86	1	0.5
26	34	2	70	90	90	1	0.5
27	30	1	50	80	80	1	0.5
28	26	2	60	80	87	1	0.5
29	27	2	70	90	86	1	0.5
30	29	2	80	100	92	1	0.5

2.6. Comparative analysis of the results

2.6.1. Comparison of the theoretical results of the two groups of methods

After the *t*-test through Graphpad Prism 8 analysis, the theoretical scores of the stratified progressive teaching method are significantly higher than that of the traditional teaching method, and the difference has statistical significance ($P < 0.05$). In **Table 1**, the students in the stratified progressive teaching method have full marks, while most of the students in the traditional teaching method are on the pass line.

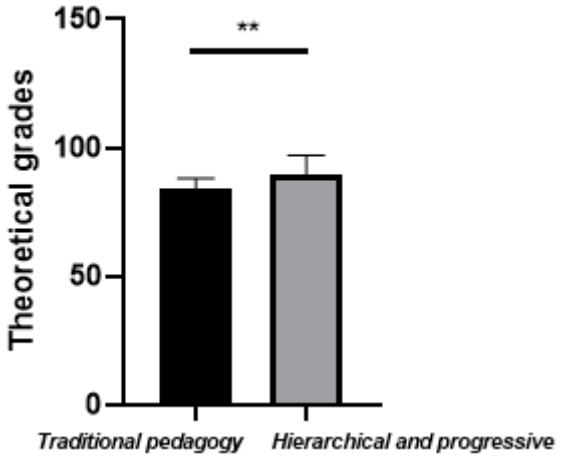

Figure 1. Comparison of the theoretical results of the two groups of methods

2.6.2. Comparison of the practical results of the two groups of methods

After the *t*-test through Graphpad Prism 8 analysis, the practical results of the hierarchical progressive teaching method are higher than that of the traditional teaching method, and the difference has statistical significance (*P*

< 0.05). In **Figure 2**, the students of the stratified progressive teaching method are more skilled than those of the traditional teaching method.

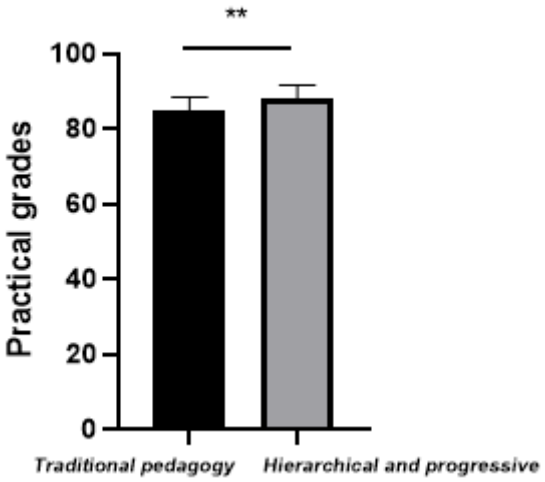

Figure 2. Comparison of the practical results of the two groups of methods

2.6.3. Comparison of teaching assessment passing time of the two groups of methods

After the *t*-test through Graphpad Prism 8 analysis, the teaching assessment passing time of the stratified progressive teaching method is shorter than that of the traditional teaching method, and the difference has statistical significance ($P < 0.05$). In **Figure 3**, the time is shortened from 2 months to half a month, so that students of the stratified progressive teaching method can learn gastroscopy skills in a short time.

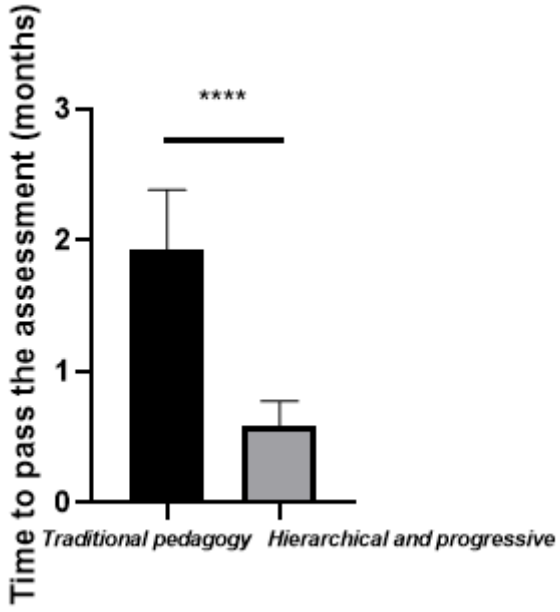

Figure 3. Comparison of teaching assessment passing time of the two groups of methods

2.6.4. Comparison of post-class satisfaction of the two groups of methods

After the *t*-test through Graphpad Prism 8 analysis, the satisfaction of the stratified progressive teaching method is higher than that of the traditional teaching method, and the difference has statistical significance ($P < 0.05$). In **Figure 4**, students of the stratified progressive teaching method get rid of the boredom of the traditional

teaching method, can join the classroom atmosphere more easily, and are more interested in the classroom.

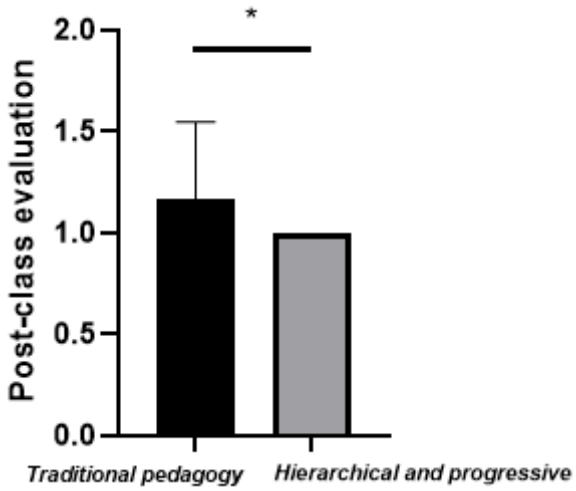

Figure 4. Comparison of post-class satisfaction of the two groups of methods

3. Conclusion

Through the analysis of the results, it is shown that the hierarchical progressive teaching method has obvious advantages in the practical practice of gastroscopy in emergency department doctors. First of all, it can meet the learning needs of different students, so that the students' theoretical results and practical results can be improved to different degrees, and the whole learning time is shortened from the original 2 months to half a month. Because each student has a different learning ability and technical level, different teaching methods and strategies need to be adopted. Secondly, it can stimulate students' interest and enthusiasm in learning. Because each student can find their training content and methods, so they will more actively participate in the training [26]. Finally, it can help teachers to better understand and evaluate the students' learning situation, and improve the quality of teaching. Because teachers can observe the actual operation of students, understand their mastery degree and existing problems, and then provide targeted guidance and help.

In contrast, the hierarchical and progressive teaching method is more flexible and personalized. It divides students according to their ability and technical level and then designs different training contents and methods for students at different levels [27]. This teaching method can not only meet the learning needs of different students and improve the teaching effect but also stimulate the student's interest and enthusiasm in learning. The learning effect of the students has also been significantly improved, and the learning time is shorter. Teachers' workload has also eased. Because teachers no longer need to spend a lot of time and effort to evaluate and group trainees, their work burden is reduced.

However, it should be noted that the hierarchical and progressive teaching method is not a panacea. In practical application, some other factors also need to be considered, such as teacher training and support, and the acceptance and participation of trainees. Therefore, studies need to continuously explore and improve the hierarchical progressive teaching method in practice, to better apply it to the gastroscopy simulation training education of emergency department physicians.

The advantages of the hierarchical progressive teaching method are mainly reflected in the following aspects. First, it can effectively meet the learning needs of different students and improve the teaching effect. Second, it can stimulate students' interest and enthusiasm in learning and improve their learning

motivation [28]. Third, it can help teachers to better understand and evaluate the learning situation of students and improve the quality of teaching. However, the hierarchical progressive approach has some limitations. First, it takes a lot of time and energy to evaluate and group students, which may increase the burden on teachers. Second, it may cause some students to feel ignored or excluded, affecting their learning enthusiasm. Third, it may restrict the free development of students and hinder the development of their personality and innovation ability. In addition to the education field, the stratified and progressive teaching method is also widely used in other fields. For example, in enterprise management, an enterprise can divide employees into different levels or groups according to their abilities and strengths, and then design suitable work tasks and development paths for employees at each level or group. In physical training, coaches can divide the athletes into primary, intermediate, and advanced levels according to their technical level and physical condition, and then design suitable training plans and methods for the athletes at each level [29].

Although the hierarchical progressive teaching method has many advantages in the simulated training education of gastroscopy in emergency department doctors, it will also encounter some problems in practical application. First, the stratified division may increase the work burden of the teachers. Because teachers need to spend a large amount of time and effort to evaluate and group students. Secondly, it may cause a proportion of the trainees to feel neglected or excluded. Because not all students can adapt to different levels of training content and methods. Finally, it may restrict the free development of the trainees. Because students may feel that they can only do things at their level, rather than try a higher level of training content and methods.

In general, the hierarchical progressive teaching method has great potential in the simulated practical education of emergency department physicians. It can not only meet the learning needs of different students and improve the teaching effect but also can stimulate the student's interest and enthusiasm in learning. The implementation of a hierarchical progressive teaching method can not only improve the quality of teaching and improve the learning effect of students but also reduce the work burden of teachers and improve work efficiency. However, it should be noted that the hierarchical progressive teaching method is not all-encompassing, so studies need to constantly explore and improve this method in practice, to better apply it in the gastroscopy simulation training education of emergency department doctors.

Disclosure statement

The authors declare no conflict of interest.

Author contributions

Study idea conceptualization: Yi Luo
Study experimentation: Yuting Chen
Data analysis: Pengman Chen
Study writing: Pengman Chen

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