

The Effectiveness of Guiding Questions Integrated Into Pulmonary Rehabilitation Health Education Videos for Chronic Obstructive Pulmonary Disease Patients: A Quasi-Experimental Controlled Study

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Purpose: Chronic Obstructive Pulmonary Disease (COPD) is a major global health concern that substantially affects patients' quality of life. Pulmonary rehabilitation exercises are effective in alleviating symptoms and reducing hospitalization rates; however, patients' learning effectiveness and motivation remain critical challenges in rehabilitation education. Given the need for accessible and sustainable patient education strategies, this study aimed to examine whether integrating guiding questions into pulmonary rehabilitation health education videos could enhance learning effectiveness and learning motivation among patients with COPD.

Patients and Methods: This study employed a prospective controlled trial with quasi-random allocation. The research was conducted in 2024 at a hospital in Taiwan, involving 60 patients with chronic obstructive pulmonary disease. Participants were divided into an experimental group (receiving guiding questions instructional strategy videos) and a control group (receiving traditional videos). Baseline and post-intervention data were collected through a learning assessment form and the learning motivation scores.

Results: Both groups showed significant improvements in learning assessment scores and motivation after the intervention ($p < 0.05$). Further comparison revealed that the experimental group had higher adjusted mean scores than the control group in both learning assessment (65.00 vs 52.00) and learning motivation (156.67 vs 137.27), with statistically significant differences.

Conclusion: The high cost of certain equipment and technological solutions often limits their widespread adoption in clinical education settings. Therefore, identifying cost-effective yet high-impact instructional strategies is essential to enhance accessibility and support the sustainable implementation of patient education. Integrating guiding questions into pulmonary rehabilitation health education videos significantly enhances patients' learning effectiveness and learning motivation. As a low-cost and scalable instructional strategy, this approach offers a practical means of strengthening educational outcomes in pulmonary rehabilitation programs for patients with COPD.

Keywords: chronic obstructive pulmonary disease, pulmonary rehabilitation, guiding questions, health education video, learning motivation

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a major global health concern and ranks among the leading causes of mortality worldwide.¹ The disease is characterized by persistent respiratory symptoms, such as dyspnea, chronic cough, and sputum production, which are often accompanied by reduced exercise tolerance and progressive functional decline.²⁻⁴ These manifestations substantially impair patients' quality of life, highlighting the growing importance of addressing lung-related diseases within healthcare.⁵

Pulmonary rehabilitation exercises, an evidence-based non-pharmacological intervention, have been shown to improve symptoms, enhance exercise capacity, and reduce hospitalization rates in patients with COPD.^{6–8} These benefits empower patients to participate more actively in daily life.^{9–11} Despite their proven efficacy, patients often exhibit low motivation and limited learning effectiveness when engaging in pulmonary rehabilitation exercises.^{9,12} This may be attributed to patients' inability to fully grasp the relevant knowledge and concepts associated with pulmonary rehabilitation exercises, as well as limitations inherent in traditional health education methods.¹³ These factors may prevent patients from achieving the expected outcomes of rehabilitation programs.¹⁴ This highlights the necessity of reevaluating and enhancing current health education approaches to improve patient learning effectiveness in pulmonary rehabilitation programs.

Advancements in technology have driven the evolution of teaching methods and strategies, leading to the integration of innovative instructional approaches.¹⁵ While technologies such as augmented reality (AR), virtual reality (VR), and artificial intelligence (AI) can enhance learning outcomes and motivation, their high costs make them inaccessible to many healthcare facilities, limiting their use in patient education. Therefore, identifying low cost and high impact teaching strategies is crucial.¹⁶

In this context, guiding questions instructional strategy presents a promising alternative. This pedagogical strategy uses targeted questions to help learners achieve specific goals and master content, and it has been widely applied across various educational settings.^{17,18} According to cognitive theories of multimedia learning, learners have limited cognitive resources, and well-designed instructional prompts can help reduce extraneous cognitive load while promoting germane processing. By incorporating guiding questions into health education videos, patients may better absorb information, fostering a deeper understanding of educational content.^{19,20} However, despite the promising potential of guiding questions instructional strategy, its application in COPD patient education remains underexplored, highlighting the need for further research in this area.

This study aims to evaluate the effectiveness of integrating guiding questions instructional strategy into pulmonary rehabilitation exercise health education videos. To achieve this, we developed a guiding questions instructional strategy video and compared its outcomes with those of traditional rehabilitation exercise videos in COPD patients. Specifically, this study seeks to determine: (1) whether using pulmonary rehabilitation exercise videos enhances learning effectiveness and motivation in COPD patients, and (2) whether guiding questions instructional strategy videos, as a cost-effective alternative, are more effective than conventional videos in achieving this effectiveness. Based on these objectives, the following hypotheses were proposed:

H1: Patients with COPD who view pulmonary rehabilitation health education videos incorporating guiding questions instructional strategy will demonstrate greater improvements in learning effectiveness than those who view conventional health education videos.

H2: Patients with COPD who view pulmonary rehabilitation health education videos incorporating guiding questions instructional strategy will demonstrate greater improvements in learning motivation than those who view conventional health education videos.

Materials and Methods

Study Populations

This study employed a prospective controlled trial design with quasi-randomized grouping. No formal prior sample size calculation was performed. The sample size was determined based on feasibility and the accessibility of patients at a single clinical center during the study period. During the enrollment period in 2024, researchers recruited 60 patients diagnosed with chronic obstructive pulmonary disease (COPD) from a hospital in Taiwan. Trained respiratory therapists conducted face-to-face interactions with patients during routine outpatient visits, briefly explaining the study objectives and procedures. All participants signed informed consent forms prior to study initiation. Patients were recruited individually. Eligible patients were assigned to groups based on the order of recruitment, such that those recruited in odd positions were placed in the experimental group, whereas those in even positions were assigned to the control group.

Inclusion criteria were adult patients, with a COPD diagnosis defined as a post-bronchodilator FEV1/FVC ratio of less than 0.7, as measured by spirometry.²¹ Participants were required to have adequate communication abilities and the capacity to perform pulmonary rehabilitation exercises. Exclusion criteria included individuals who were unable to communicate effectively or were incapable of participating in pulmonary rehabilitation exercises.

Study Design

In this study, the independent variable was the type of educational video intervention, while the dependent variables were learning effectiveness and learning motivation. Patients in the control group received instruction through traditional health education videos, while patients in the experimental group were taught using health education videos designed based on a guiding questions instructional strategy. The primary distinction between the two types of health education videos lies in the latter's integration of the guiding questions instructional strategy. The total duration of the educational videos was approximately 15 minutes. Participants viewed the videos once under supervision during the intervention period. To ensure consistency among participants, repeated viewings were not permitted during the study period.

The research process includes the following steps: First, patients are assigned to either the experimental group or the control group in the order of enrollment. Baseline data were then collected via a pretest. Specifically, trained researchers conducted face-to-face interviews to collect demographic and clinical information. The Chronic Obstructive Pulmonary Disease Assessment Test (CAT) was administered using a paper-based questionnaire. When necessary, researchers explained questionnaire items without influencing participants' responses. Subsequently, the control group received instruction via traditional pulmonary rehabilitation exercise health education videos, while the experimental group was taught using videos incorporating a guiding questions instructional strategy. Finally, posttest data were collected from both groups after completing the health education sessions, followed by a thorough data analysis.

Ethical Approval

This study adhered to the principles outlined in the Declaration of Helsinki and received ethical approval from the Institutional Review Board on February 23, 2024. All eligible participants will be invited and fully informed of research objectives and procedures. Informed consent will be obtained voluntarily before the start of the study. Participants will be clearly informed that their participation is entirely voluntary and that they may withdraw from the study at any point without any negative consequences.

Research Interventions

The Traditional Health Education Video

This video is structured into three main sections; “Preparatory Steps for Diaphragmatic Breathing”, “Execution of Diaphragmatic Breathing”, and “Precautions During Diaphragmatic Breathing”.²²

1. **Preparatory Steps for Diaphragmatic Breathing:** This section introduces the preparatory actions necessary for diaphragmatic breathing. It includes guidance on adjusting sitting posture, relaxing the shoulders and neck, and correctly positioning the hands.
2. **Execution of Diaphragmatic Breathing:** This segment provides a detailed explanation of the correct posture and techniques for diaphragmatic breathing. It emphasizes the importance of regulating breathing rhythm and effectively performing the exercise.
3. **Precautions During Diaphragmatic Breathing:** The video concludes with an overview of essential precautions to observe while practicing diaphragmatic breathing. Patients are reminded to avoid overexertion to minimize the risk of potential complications or adverse effects.

The Guiding Questions Instructional Strategy Health Education Video

This video is structured similarly to the traditional health education video, comprising three main sections. However, its key feature is the inclusion of “guiding questions” prior to each segment to enhance patient attention and optimize learning effectiveness.

For example, before the “Preparatory Steps for Diaphragmatic Breathing” segment, the video presents questions such as: “Are you sitting up straight?” and “Are your hands correctly positioned, with one hand on your chest and the other on your abdomen?” This approach directs patients’ focus toward these essential elements during the subsequent video content, thereby enhancing their comprehension and learning effectiveness.

Outcome Measures

The evaluations in this study were conducted before and after the pulmonary rehabilitation exercise health education video sessions, focusing on patients’ understanding of key pulmonary rehabilitation concepts and their knowledge acquisition. A learning effectiveness assessment form was developed based on the content of the health education videos, consisting of seven binary-response items (“correct” or “incorrect”), with each correct response awarded 10 points and incorrect responses scored as 0 points. Although the use of dichotomous items may limit measurement sensitivity and depth, this format was intentionally chosen to ensure feasibility, clarity, and appropriateness for patients with COPD in a clinical setting, as many participants were older adults with chronic disease who might have difficulty completing cognitively demanding multiple-choice questions (eg, five-option formats) within a limited time.

This assessment form was developed by the research team and reviewed by two respiratory therapists and one physician to ensure content validity. The three professionals comprised two males and one female, all holding master’s degrees or higher and possessing over 10 years of combined medical and teaching experience. The three professionals evaluated aspects such as the appropriateness and relevance of the items, using a four-point rating scale to assess content validity. Additionally, the Cronbach’s alpha coefficient for this assessment form is 0.7, indicating good reliability. Relevant examples include statements such as: “Is the overall respiratory rate for diaphragmatic breathing 2–3 seconds for inhalation and 4–6 seconds for exhalation?”.

Furthermore, the study employed the Intrinsic Motivation Inventory (IMI) as revised by Yin et al, originally developed by McAuley et al. The IMI consists of five subscales: interest-enjoyment, tension-pressure, perceived choice, perceived competence, and perceived value, comprising a total of 25 items.^{23,24} An example item is, “This way of learning was fun.” Responses were rated on a 7-point Likert scale, with higher scores indicating stronger learning motivation. The Cronbach’s α coefficients for the subscales were 0.86, 0.86, 0.74, 0.86, and 0.84, respectively, demonstrating adequate reliability of the scale.

Statistical Analysis

Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS) to summarize baseline characteristics. Continuous variables were reported as means and standard deviations, whereas categorical variables were presented as frequencies or percentages.

Within-group comparisons of pretest and posttest results were conducted using paired sample t-tests. Between-group comparisons were analyzed using chi-square tests, independent sample t-tests, or analysis of covariance (ANCOVA), depending on the suitability of each test. Statistical significance was defined as a P value < 0.05.

Results

During the research period in 2024, 60 patients diagnosed with COPD were recruited. All patients met the eligibility criteria for participation in the study. Of the 60 participants, 30 were assigned to the experimental group, which received a guiding questions instructional strategy health education video, while the remaining 30 were assigned to the control group, which received a traditional health education video. The flow of participants in this study is illustrated in Figure 1.

Baseline Characteristics

The baseline characteristics of the two groups were comparable (Table 1). For continuous variables, including CAT score, pretest learning assessment form scores, and pretest learning motivation scores, no statistically significant differences were observed between the groups, with all p-values > 0.05.

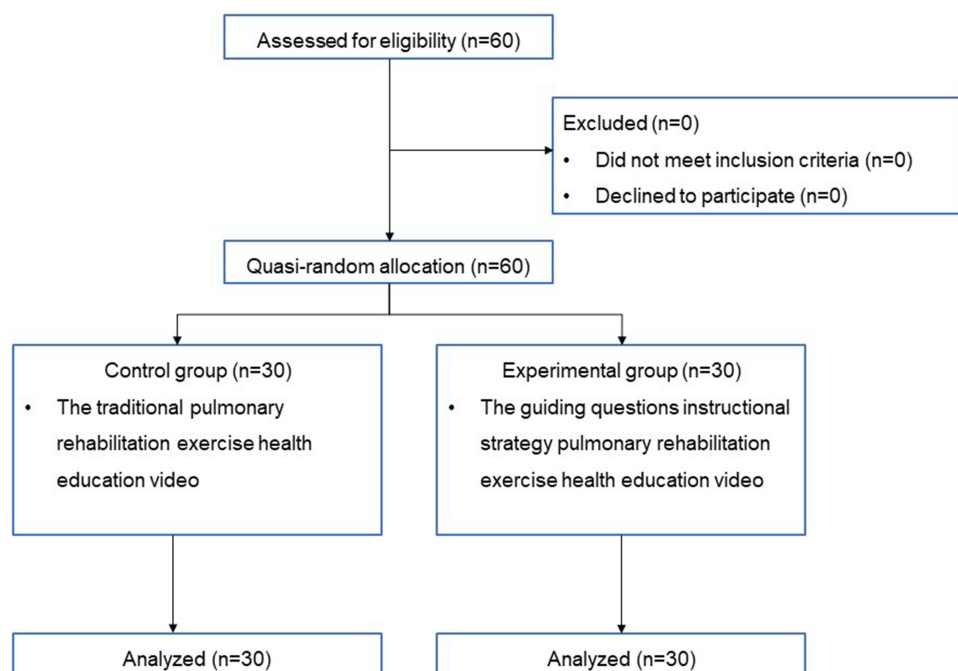


Figure 1 Case collection flow chart.

Similarly, for categorical variables, including gender and awareness of pulmonary rehabilitation exercises, no statistically significant differences in distribution were found between the groups, with all p -values > 0.05 . These findings indicate that, prior to the intervention, participants in both the experimental and control groups demonstrated similar levels of disease impact, baseline knowledge, gender distribution, awareness of pulmonary rehabilitation exercises, and motivation for learning. This comparability minimizes the likelihood that pre-existing differences influenced the study outcomes.

Learning Effectiveness and Learning Motivation Within the Two Groups

Table 2 presents the results of paired samples t -tests for learning outcomes within the two groups. For learning assessment scores, the experimental group demonstrated a significant increase from a pretest mean of 10.33 ($SD = 16.71$) to a posttest mean of 65.33 ($SD = 12.80$), with a t -value of 16.26 ($p < 0.05$) and an effect size of 3.70. Similarly, the control group showed a significant improvement, with scores rising from a pretest mean of 8.33 ($SD = 14.64$) to a posttest mean of 51.67

Table 1 Characteristics of Subjects at Baseline

Characteristic		Experimental Group (n=30)	Control Group (n=30)	p
		Mean (SD)	Mean (SD)	
CAT score		12.50 (5.95)	15.43 (8.13)	0.12
Pretest learning assessment form scores		10.33 (16.71)	8.33 (14.64)	0.62
Pretest learning motivation scores		103.33 (10.93)	102.23 (11.03)	0.70
		n (%)	n (%)	
Gender	Male	27 (90%)	27 (90%)	1.00
	Female	3 (10%)	3 (10%)	
Do you know what pulmonary rehabilitation exercises are?	Yes	3 (10%)	3 (10%)	1.00
	No	27 (90%)	27 (90%)	

Table 2 T-Test Results for Learning Outcomes Within the Two Groups

Dimension	Experimental Group (n=30)				Control Group (n=30)			
	Pretest	Posttest	t	d	Pretest	Posttest	t	d
	Mean (SD)	Mean (SD)			Mean (SD)	Mean (SD)		
Learning assessment form scores	10.33 (16.71)	65.33 (12.80)	16.26*	3.70	8.33 (14.64)	51.67 (17.04)	14.41*	2.73
Learning motivation total scores	103.33 (10.93)	156.83 (16.69)	15.24*	3.79	102.23 (11.03)	137.10 (15.02)	12.59*	2.65
• Interest-enjoyment scores	29.30 (4.37)	43.27 (5.68)	10.86*	2.76	28.57 (3.00)	37.80 (6.05)	8.37*	1.93
• Tension-pressure scores	20.00 (3.94)	6.80 (3.79)	13.00*	3.40	19.33 (2.86)	11.77 (5.80)	7.24*	1.67
• Perceived choice scores	16.67 (2.38)	24.13 (2.97)	11.74*	2.77	16.33 (1.88)	21.57 (3.30)	8.61*	1.95
• Perceived competence scores	20.57 (2.81)	29.83 (4.37)	11.16*	2.52	20.17 (1.98)	25.90 (4.01)	7.97*	1.81
• Perceived value scores	16.77 (2.62)	26.40 (2.36)	15.43*	3.86	16.50 (2.13)	23.60 (3.02)	11.66*	2.71

Note: *p < 0.05.

(SD = 17.04), accompanied by a t-value of 14.41 ($p < 0.05$) and an effect size of 2.73. These findings indicate that both learning models positively impacted patients' learning effectiveness.

In terms of learning motivation total scores, the experimental group's mean significantly increased from 103.33 (SD = 10.93) before the test to 156.83 (SD = 16.69) after the test, with a t-value of 15.24 ($p < 0.05$) and an effect size of 3.79. The control group also exhibited a significant rise, with scores increasing from a pretest mean of 102.23 (SD = 11.03) to a posttest mean of 137.10 (SD = 15.02), and a t-value of 12.59 ($p < 0.05$) and an effect size of 2.65.

Further analysis of the learning motivation subscales revealed significant improvements across all dimensions in both groups. Subscales such as interest-enjoyment, tension-pressure, perceived choice, perceived competence, and perceived value demonstrated notable enhancements ($p < 0.05$). In the experimental group, the effect sizes for each subscale were interest-enjoyment ($d = 2.76$), tension-pressure ($d = 3.40$), perceived choice ($d = 2.77$), perceived competence ($d = 2.52$), and perceived value ($d = 3.86$). In the control group, the effect sizes were interest-enjoyment ($d = 1.93$), tension-pressure ($d = 1.67$), perceived choice ($d = 1.95$), perceived competence ($d = 1.81$), and perceived value ($d = 2.71$). These findings highlight the intervention's effectiveness in comprehensively improving various aspects of learning motivation.

In particular, large effect sizes were observed in both groups for learning effectiveness and learning motivation. Effect sizes were calculated using Cohen's d , defined as the mean difference between pretest and posttest scores divided by the pooled standard deviation. These effect sizes can be attributed to the substantial mean differences between pretest and posttest scores, as well as the low baseline scores and the highly targeted, content-specific nature of the intervention. In addition, these effect sizes provide further evidence supporting the significance of within-group changes following the learning intervention.

Overall, these results indicate that both groups experienced statistically significant improvements in learning assessment scores and learning motivation total scores following the intervention. Additionally, the reduction in stress scores (reverse-scored items) and the improvement in other subscales also demonstrate the impact of the intervention on various aspects of learning motivation (Table 2).

However, although both groups showed significant improvements in learning motivation after the video instruction, the d -values in the control group were consistently lower across all dimensions compared to the experimental group (Figure 2).

Notably, regardless of the video type, patients achieved the highest scores in perceived value, with an effect size of 3.86 in the experimental group and 2.71 in the control group. This indicates that, regardless of the type of video watched, patients highly value pulmonary rehabilitation exercises. Additionally, the largest difference between the two groups was observed in tension-pressure scores, suggesting that a guiding questions instructional strategy may be particularly effective in reducing anxiety and pressure during the learning process.

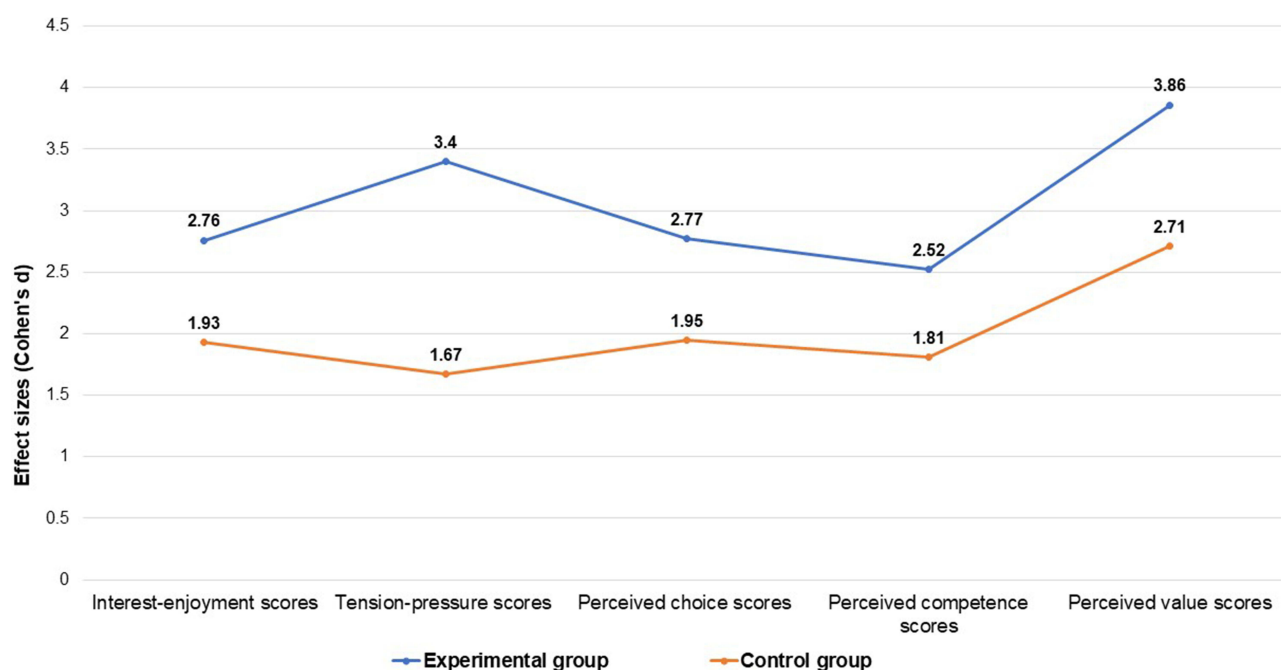


Figure 2 The effect size changes in learning motivation between two groups.

Learning Effectiveness and Learning Motivation Between the Two Groups

Levene's test for homogeneity of variances indicated that the assumption of equal variances was not violated ($F = 0.94$, $p > 0.05$), allowing for the use of ANCOVA. As shown in Table 3, after controlling for the effects of pretest scores, the results revealed that the experimental group significantly outperformed the control group.

Table 3 presents a comparison of learning effectiveness between the experimental and control groups. The experimental group achieved an adjusted mean score of 65.00 on the learning assessment, whereas the control group obtained an adjusted mean of 52.00. The ANCOVA analysis indicated a statistically significant difference between the two groups ($p < 0.05$).

Similarly, for overall learning motivation, the experimental group had an adjusted mean score of 156.67, compared to 137.27 in the control group. This difference was also statistically significant ($p < 0.05$).

Table 3 ANCOVA Results for Learning Outcomes Between the Two Groups

Dimension	Group	N	Mean	SD	Adjusted Mean	F
Learning assessment form scores	Experimental group	30	65.33	12.80	65.00	12.46*
	Control group	30	51.67	17.04	52.00	
Learning motivation total scores	Experimental group	30	156.83	16.69	156.67	22.95*
	Control group	30	137.10	15.02	137.27	
• Interest-enjoyment scores	Experimental group	30	43.27	5.68	43.20	12.20*
	Control group	30	37.80	6.05	37.81	
• Tension-pressure scores	Experimental group	30	6.80	3.79	6.75	15.90*
	Control group	30	11.77	5.80	11.82	
• Perceived choice scores	Experimental group	30	24.13	2.97	24.08	9.46*
	Control group	30	21.57	3.30	21.62	
• Perceived competence scores	Experimental group	30	29.83	4.37	29.74	12.59*
	Control group	30	25.90	4.01	25.99	
• Perceived value scores	Experimental group	30	26.40	2.36	26.38	15.49*
	Control group	30	23.60	3.02	23.62	

Note: Homogeneity test of result: $F = 0.94$, $p = 0.336 > 0.05$; * $p < 0.05$.

Further analysis of the learning motivation subscales revealed significant differences favoring the experimental group across all dimensions. These subscales interest-enjoyment, tension-pressure, perceived choice, perceived competence, and perceived value all showed significantly higher scores in the experimental group ($p < 0.05$).

These findings suggest that the guiding questions instructional strategy health education intervention significantly enhanced both learning assessment performance and learning motivation overall and across all subscales compared to the traditional health education method.

Discussion

Interpretation of Results

This single-center quasi-experimental controlled trial, involving 60 patients with COPD. The results revealed significant improvements in both learning effectiveness and motivation in both the experimental and control groups following the educational intervention.

These findings are consistent with previous literature. For instance, Moon and Hyun demonstrated that blended learning programs for cardiopulmonary resuscitation (CPR) training, incorporating video content, were more effective in improving learning effectiveness compared to traditional face-to-face teaching methods.²⁵ Similarly, Pratiwi et al examined the effects of face-to-face and video-based teaching methods on learning effectiveness and motivation, reporting that while both approaches were effective, video-based teaching yielded more pronounced benefits.²⁶ Furthermore, Ismail et al highlighted that audiovisual media were superior to conventional health education methods in enhancing learning motivation.²⁷ Collectively, these studies underscore the significant advantages of using educational videos in health education.

Beyond these general effects, the present study further demonstrated that the experimental group achieved significantly greater improvements in learning effectiveness and learning motivation than the control group, underscoring the added value of integrating a guiding questions instructional strategy into video-based education. This finding also aligns with prior research. Martinez-Pozas et al emphasized that different rehabilitation delivery modalities exert varying impacts on patient engagement and outcomes.²⁸ Meanwhile, Sánchez-Romero et al reported that incorporating structured, evidence-based educational tools into pulmonary rehabilitation programs enhances patient participation and learning effectiveness.²⁹ Furthermore, past research on guiding questions instructional strategy indicates this approach can enhance learners' attention, cognitive engagement, and achievement of instructional objectives.^{17,18,30} This strategy is particularly crucial in rehabilitation education, as studies indicate motivation, self-efficacy, and psychological commitment are key factors influencing learners' engagement with educational content and programs.³¹

Existing evidence-based literature also supports these findings. Lawson et al demonstrated the benefits of guiding questions instructional strategy videos in social psychology education, where students receiving such instruction scored significantly higher on course-related assessments compared to control groups.³² Similarly, Brown et al reported that guided reading questions improved students' reading motivation and comprehension.²⁰ Brame also emphasized that tools that help students process information and monitor their understanding are crucial for maximizing the benefits of educational videos, with guiding questions instructional strategy being an effective example.¹⁹ The findings of our study reinforce the notion that guiding questions instructional strategy significantly enhance the effectiveness of video-based learning.

It is noteworthy that the present study found that integrating guiding questions instructional strategy into pulmonary rehabilitation health education videos positively influenced multiple dimensions of learning motivation. Because no significant baseline differences in learning motivation were observed between groups, the within-group effect sizes can be interpreted as reflecting the short-term impact of the educational intervention.

The results indicate that the experimental group consistently demonstrated larger effect sizes than the control group across learning motivation dimensions, with the most pronounced difference observed in tension–pressure. This suggests that guiding questions instructional strategy videos may help reduce learning-related stress. This finding is in line with prior work indicating that well-designed educational videos can facilitate information processing and reduce anxiety associated with learning challenges.¹⁹ Additionally, perceived value reflects patients' expectations regarding the benefits

they gain from health educational videos. The findings showed that, regardless of the group, participants exhibited the highest effect sizes in perceived value, indicating a general recognition of the high value of these videos for learning. Moreover, the effect size in the experimental group was higher than that in the control group, further validating the effectiveness of applying guiding questions instructional strategy in health education videos.

Importantly, while these findings primarily reflect improvements in education and engagement-related outcomes, they should be interpreted as intermediate indicators supporting rather than directly determining clinical efficacy. In other words, these results do not represent immediate functional or physiological changes. However, the relevant literature also suggests that these intermediate outcomes may contribute to enhanced clinical efficacy by strengthening patients' understanding, motivation, and participation in pulmonary rehabilitation. As noted by Corbellini et al, effective pulmonary rehabilitation can improve thoracic mobility, thereby altering respiratory function indicators such as arterial blood carbon dioxide partial pressure.³³ This suggests that learning outcomes and learning motivation may exert potential influences on subsequent physiological changes.

Finally, this study, the strategy was incorporated into an existing traditional health education video by embedding guiding questions instructional strategy into key sections, without the need to redesign or recreate the entire material. This approach offers a low-cost yet high-impact enhancement to traditional educational formats, maximizing learning outcomes without relying on expensive resources. It is particularly suitable for healthcare settings with limited budgets, as it not only improves patients' learning effectiveness and motivation but also serves as a practical and accessible alternative to costly instructional tools or strategies, facilitating broader implementation. As noted by Justribó-Manion et al in their systematic review of active conservative interventions for obstructive sleep apnea, despite limited evidence supporting current interventions, low-cost, non-invasive alternative strategies demonstrate considerable potential for application.³⁴ Based on this, the findings of this study further supplement the relevant literature, demonstrating that within health education settings, simplified and feasible instructional design adjustments can still yield tangible benefits for short-term learning and motivation enhancement, highlighting the practical value and research significance of this study.

Limitations and Future Research Suggestion

Despite its contributions, this study has several limitations that should be acknowledged. First, the sample size was modest and determined pragmatically without a formal power calculation, as this study was designed as an exploratory educational intervention. Although statistically significant effects were observed, the limited sample size may restrict statistical power. Second, the single-center design may limit the generalizability of the findings to other clinical settings or patient populations. Differences in patient characteristics, educational environments, and rehabilitation practices across centers may influence the effectiveness of guiding questions instructional strategy educational videos. Therefore, the results should be interpreted as preliminary, and future multicenter studies with larger samples are needed to validate and extend these findings. In addition, the study employed a prospective quasi-experimental controlled trial design in which group allocation was based on the order of recruitment; although this approach facilitated balanced group sizes, it did not constitute true randomization and may have introduced a potential risk of selection bias, which should be taken into account when interpreting the results. Second, the learning assessment tool was content-specific and consisted of a limited number of binary-response items, which may have constrained the sensitivity of the measurement. Third, the study timeframe was designed to assess short-term learning effectiveness and motivation following the educational intervention; therefore, conclusions regarding long-term knowledge retention or sustained behavioral change cannot be drawn.

Future studies should incorporate larger and more diverse patient cohorts, adopt a multicenter study design, and extend follow-up periods to better evaluate the long-term and universal applicability of guiding questions instructional strategy in pulmonary rehabilitation. Additionally, the SPANOVA statistical method could be employed to explore interactions between and within groups, examining the relationship between outcomes and motivation.

Conclusion

The findings of this study highlight the potential value of incorporating guiding questions instructional strategy into health education for patients with COPD. The results demonstrated significant improvements in learning assessment scores and learning motivation among participants after viewing pulmonary rehabilitation health

education videos, underscoring the educational benefits of video-based instruction for supporting patient learning. Furthermore, participants who received guiding questions instructional strategy videos showed greater improvements in learning effectiveness and motivation compared with those who viewed traditional videos, indicating that this instructional strategy can more effectively enhance educational engagement.

Given the limitations of healthcare resources, guiding questions instructional strategy offer a cost-effective, scalable, and practical approach to enhancing patient education. This learner centered method not only improves comprehension but also significantly boosts patients' motivation to engage with educational content. Health educators and clinicians are encouraged to integrate such strategies into routine pulmonary rehabilitation education programs to promote better learning outcomes.

Data Sharing Statement

The datasets generated or analyzed during the current study are available from the corresponding author on reasonable request, but are not publicly accessible due to privacy or ethical considerations.

Ethics Approval and Informed Consent

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the Taipei Veterans General Hospital (No. 2024-03-019AC).

Consent for Publication

All participants signed informed consent, including permission to publish anonymous responses and direct quotes.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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