STRATEGIES AND PROCEDURES FOR TRAINING PHYSICS EDUCATION STUDENTS IN DEVELOPING LESSON PLANS IN ENGLISH

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Abstract: *In the training of Physics education teaching in English, guiding students to develop lesson plans for teaching physics in secondary school and high school plays an important role in the curriculum and contributes to achieving the program's overall objectives. The purpose of the study is to propose strategies and a procedure for guiding physics education students in developing lesson plans for physics in English. To accomplish this, we evaluate current practices of guiding students to develop lesson plans and analyze several research results related to lesson planning. Based on this analysis, a procedure for supporting students in designing lesson plans in English is proposed. The research identifies specific steps in the procedure, including the importance of using subject-specific terminology in both lesson planning and teaching activities. This proposed procedure is expected to significantly support lecturers in guiding students and enable students to develop lesson plans more effectively.*

Keywords: *lesson plan, physics education, teaching in English, physics students, specific terminology.*

1. INTRODUCTION

Preparing lesson plans is a compulsory and essential step in teaching preparation. A lesson plan is an instructional script for teachers with specific student groups and content. It also reflects the teaching methods, teaching aids, and assessment forms that align with the expected learning outcomes regarding competencies and qualities of students [1].

The lesson plan plays an important role and directly influences the success of the teaching and learning process [2]. A lesson plan provides a general outline that guides teachers in delivering content and helping students achieve learning objectives effectively through appropriate learning activities [3]. It outlines learning objectives and the strategies to attain them, such as how learning activities are organized and assessed [4].

For students majoring in Physics education teaching through English at Hanoi Pedagogical University 2, the curriculum includes these courses: English for specific purposes (Physics), English for teaching Physics, and Teaching practice. Similar to other teacher education programs, guiding students in making lesson plans is a key component,

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integrated across multiple modules such as Theory of teaching Physics, Using the software in teaching Physics, Teaching practice, and English for teaching Physics. The ability to create lesson plans in English for teaching physics at the school level is of great importance in helping students prepare for pedagogical internship and teaching practice. However, to enhance the effectiveness of training students to design lesson plans, it is essential to have teaching strategies that match the English levels of students and the specific requirements of planning physics lessons in English.

In this work, we propose strategies and a procedure for training students to develop lesson plans in English, with the aim of improving the quality of guiding students in designing physics lesson plans in English.

2. RESEARCH CONTENT

2.1. Strategies for guiding students in developing lesson plans

To establish a practical basis for proposing strategies, we conducted a survey with four lecturers who teach English for Specific Purposes (Physics), English for teaching Physics, and Teaching Practicum (for Physics education students teaching in English), in order to identify the main difficulties that the students encounter when designing lesson plans. The survey questions and responses are presented in Table 1.

Table 1. *Survey questions for lecturers and their responses*

The questions	The lecturers' responses
Question 1: What difficulties do physics education students face when using English for specific purposes (Physics) to develop lesson plans?	All four lecturers agreed that physics education students struggle with accurately using specialized English terminology in physics, expressing complex physics concepts in English, and lacking confidence when teaching in English. Additionally, there is a shortage of specialized physics resources to support developing lesson plans in English.
Question 2: What challenges do physics education students encounter when using English-language materials to develop lesson plans?	All four lecturers agreed on several key challenges: Physics education students struggle with comprehending English-language specialized materials, particularly abstract and advanced concepts, complex grammatical structures, and expressions that differ from Vietnamese. Additionally, they face

	difficulties in translating content from English sources into lesson plans.
Question 3: Do you provide students with a procedure for designing a lesson plan (including steps, assessment criteria, and expected outcomes for each activity)? If so, please attach the procedure to your response below.	Two lecturers provided a procedure that includes outlining activities based on the lesson plan development framework according to Appendix 4 of Official Document No.5512.
Question 4: Could you suggest a procedure for guiding students in developing physics lesson plans in English?	Three lecturers suggested a procedure consisting of the following steps: (1) identify the lesson objectives in English; (2) Analyze the lesson content and specialized physics terms. Select and adapt content: transforming academic content into language suitable for secondary school students; (3) Design instructional activities that align with both the content and the language; (4) Choose appropriate teaching strategies, instructional formats, and assessment tools in English; (5) Review and present the lesson plan in English to the class for feedback and refinement.

Based on the analysis of lecturer interview results, we propose three strategies to guide students in effectively developing lesson plans. These strategies are integrated into the procedure for supporting students in lesson plan development.

Strategy 1: Adding subject-specific terminology

Purpose: is to enable students to accurately and effectively use subject-specific terminology when writing the components of a lesson plan.

Content: Students are provided with a list of subject-specific terms relevant to writing learning objectives, lesson content, describing teaching equipment and learning materials, and the design of teaching activities. Each term is clearly explained in terms of its meaning and contextual usage. The selected terminology aligns with the objectives and content of physics at the school level. Additionally, students are guided to use appropriate verbs to write learning objectives based on Bloom's taxonomy, as illustrated in Table 2 [5].

Table 2. Anderson and Krathwohl's revision of Bloom's cognitive domain hierarchy

Cognitive Domain Hierarchy	Associated Actions
Remember	define, describe, state, list, name, write, recall, recite, recognize, label, select, outline, match
Understand	Explain, classify, indicate, formulate, justify, contrast, select, discuss, distinguish, plot.
Apply	Predict, calculate, apply, solve, demonstrate, perform, assess, compute, use, show.
Analyze	Analyze, compare, separate, resolve, conclude, differentiate, illustrate, diagram.
Evaluate	Evaluate, estimate, measure, determine, summarize, defend, examine, assess, and judge.
Create	Develop, design, devise, generate, propose, build, form, create, invent.

The list of subject-specific terms and expressions is compiled from reputable sources (phrases available at https://byvn.net/ar01) and physics content from reference books such as Cambridge International AS and A Level Physics Coursebook and Oxford AQA International A-Level Physics.

Strategy 3: Guidance for activity-based lesson plan development

Purpose: is to provide students with a clear framework for the sequence, objectives, and expectations of each activity involved in developing a lesson plan.

Content: Students are provided with a structured table that explicitly outlines the procedural sequence and expected products of each activity (Table 3). Students are required to present, describe, and explain the role of each activity in the process. Students are guided to follow each step in the sequence, and the teacher evaluates the outcomes of each activity based on established lesson plan assessment criteria.

Strategy 3: Repeat practice in lesson plan development

Purpose: to enhance students' proficiency in developing lesson plans through repeated practice aligned with the structured lesson planning activities.

Content: A series of physics topics are selected for students to practice lesson plan development. Students are provided with commonly used subject-specific phrases for

teaching various types of physics content, including concepts, laws, phenomena, and their application. These lesson plans can be designed to incorporate experiments, interactive simulations, video analysis software, and recorded demonstrations of physical phenomena. Students sequentially design lesson plans for these topics, evaluate and revise their work, and reflect on each product to enhance the quality and effectiveness of subsequent lesson plans.

2.2. Procedure for guiding students in developing lesson plans

An analysis of the curriculum for physics education teaching in English at Hanoi Pedagogical University 2 [6] and current teaching practices reveals that the key features of training physics education students in lesson plan development include requiring students to create lesson plans for various physics content; providing lesson plan templates and assessment rubrics. Once a lesson plan is completed, students engage in discussions to review and conduct peer evaluations. During this process, students are expected to use discipline-specific English terminology. Additionally, based on lecturer feedbacks (Question 3 in the survey), a procedure is proposed to guide students in lesson plan development, outlining the steps shown in Figure 1.

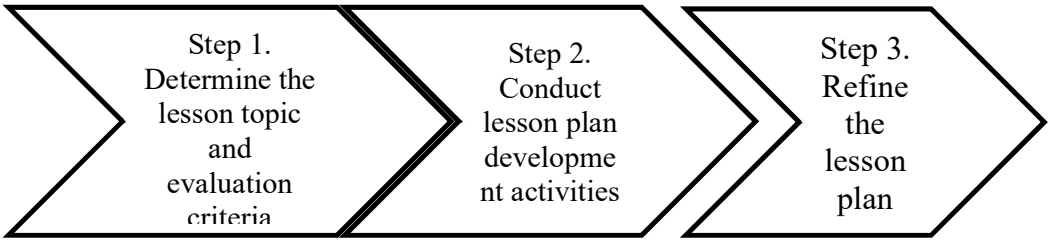


Figure 1. *A procedure for guiding students in developing lesson plans*

In these above steps, strategy 1 is applied during steps 2 and 3 when selecting discipline-specific terminology, strategy 2 is utilized in step 2 for lesson plan construction. All three strategies (1-3) are subsequently employed when students develop lesson plans for subsequent topics.

Step 1. Determine the lesson topic and evaluation criteria

Based on the expected learning outcomes (in the General Education Curriculum 2018), the students analyze topic content and consult textbooks to determine the specific lesson content, and since then propose the structure and duration of the lesson. Criteria for evaluating the lesson plan are also analyzed, including the evaluation of objectives (refer to the criteria in document [7]), teaching equipment and learning materials, learning activities, and assessment methods (refer to document [8]). The students finally orient the

products of the lesson plan development activities. A system of lesson plan evaluation criteria can be referenced at the following link https://byvn.net/CS7c.

Step 2. Conduct lesson plan development activities

Based on the analysis of the lesson plan structure in No.5512 official dispatch issued by the Ministry of Education and Training [9], and with reference to lesson plan development activities in [2] [10], the lesson plan development activities and their corresponding expected outcomes are described in Table 3. In this process, we augment an activity that is selecting subject-specific terminology activity at the first step. These activities should be conducted sequentially to establish a coherent structure for the lesson plan. Additionally, some activities may need to be repeated to revise specific components of the plan, ensuring that the teaching and learning activities are logically connected and aligned with the learning objectives, content, teaching equipment, and learning materials.

Table 3. *Key Activities in Lesson Plan Development and Expected Outcomes*

Activities	Expected outcomes
1. Selecting subject-specific terminology	- A well-written lesson plan objective typically begins with one of the following structures: *By the end of this lesson, students should be able to...* *By the completion of this activity, participants will be able to...* *After studying this section, students will be able to...* *Upon completing this course, learners will be able to...* - Subject-specific terms used to write learning objectives and describe concepts, laws, phenomena, mathematical expression, experiment, or their applications presented in the lesson.
2. Determining learning objectives	Objectives appropriate to the students, written based on the expected learning outcomes of General Education Curriculum 2018. Instructional objectives should be specific, measurable, short-term, and observable student behaviors [11] matched to Bloom's taxonomy as described in Table 2. Objectives are usually single sentences including an action verb and specify the competence or knowledge students are expected to acquire.
3. Determining learning content	The learning content is described using nouns and includes concepts, laws, physics phenomena and their applications, experiments, and exercises. This content helps students achieve the learning objectives.

4. Selecting teaching aids and materials	Describe the teaching equipment suitable for the learning objectives and content (including tools and computer-assisted experiments). The teaching materials should align with teaching activities and contain information that helps students achieve goals (including printed papers, digital resources, and instructional software). Provide links to these materials.
5. Designing learning activities	**Activity 1. Introduction/Identifying the Problem** The activity title should be explicit, reflecting both the physics content and expected outputs. Each activity should include a well-defined objective and an organization method in the following steps: • The teacher assigns tasks: Clearly outlines the tasks that students are expected to carry out, such as problem-solving, answering questions, doing exercises, or analyzing physics experimental results related to physics content. • Students complete the tasks and report task result. • The teacher evaluates and concludes. The outcome of the first activity should identify the problem or task that needs to be addressed.
	Activity 2. Constructing new knowledge /Solving problems/ Performing tasks set in Activity 1 The activity title must be clear, reflecting both the content and expected outputs. The activity should describe clearly how students engage with learning materials, teaching aids, and their working methods. It should also explain how students solve the problems or perform the tasks assigned in Activity 1.
	Activity 3. Practice Describe the system of questions and exercises for students to practice, and provide methods for assessing and giving feedback on their performance.
	Activity 4. Application Clearly describe the content in which students apply their knowledge and implement these activities.
6. Identifying assessment methods for learning activities	Describe the methods for both formative and summative assessment of learning activities, based on questions, exercises, and assessment rubrics.

Step 3. Refine the lesson plan

Organize activities for students to use the criteria to assess the current lesson plan, indicate components that do not meet the success criteria, and revise accordingly to ensure coherence and effectiveness. Based on this process, students apply the skills they have developed to improve subsequent lesson plans.

2.3. An illustrative example of a physics lesson plan

Applying the procedure for guiding students in developing that is proposed in section 2.2 to guide them in designing a lesson plan on the topic of Frictional Force, the detailed steps are implemented as follows:

Step 1. Determine the lesson topic and evaluation criteria

Based on the Physics program in the General Education Curriculum 2018 and the reference Physics textbook, the lesson on Frictional Force is divided into two class periods. The criteria for evaluating the lesson plan are analyzed to ensure consistency with the developed lesson plan outcomes on the given topic.

Step 2. Conduct lesson plan development activities

The activities for developing the lesson plan are described in Table 4.

Table 4. *Expected outcomes in guiding students to develop a lesson on Frictional force*

Activities	Expected outcomes
1. Selecting subject-specific terminology	Rough and smooth surfaces, normal force, static friction, relative movement, sliding friction, coefficient of friction, contact area, and opposes the motion.
2. Determining learning objectives	By the end of this lesson, students should be able to: Competence objectives: - Define static friction and describe its characteristics. - Describe the characteristics of sliding friction. - Identify the advantages and disadvantages of friction in daily life. - Apply the formula for friction to solve exercises involving sliding friction. Affective objectives: - Diligence: maintain a positive attitude toward learning and actively participate in classroom activities.

	- Honesty: demonstrate honesty when conducting experiments to investigate the factors influencing the magnitude of sliding friction.
3. Determining learning content	Content includes: Static friction (concept and characteristics), sliding friction (concept, characteristics, and formula), and applications of frictional force. The detailed instructional content is referenced from the materials [12], [13].
4. Selecting teaching aids and materials	- Images illustrating rough and smooth surfaces - Experimental equipment, including rectangular wooden blocks, weights, a smooth surface, a rough surface, a dynamometer, and two marbles. - A video related to friction: https://www.youtube.com/watch?v=TkXAJHitPAY
5. Designing learning activities	
Activity 1: Identifying the Problem ***Aims:*** To engage students and introduce foundational information related to friction. To introduce the question of the day "What is friction?" and "What are the characteristics of frictional force?" ***Instructional procedure:*** 1. Task Assignment: - The teacher introduces a vocabulary-based game to engage students and activate key physics terms learned in Grade 6. The class is divided into two groups, and each selecting a representative to face away from the board. The teacher uses a projector to display terms such as *friction, prevent the motion, smooth, rough, normal force, slide,* and *static*. Group members use English and gestures to help their representative guess the terms. - The teacher has students discuss to give examples of motion involving friction and raise the question of characteristics of friction. 2. Task Implementation: - The group members discribe the word, and the representative guesses. Each correct guess earns one point. The group with the most points wins.	

- Discuss to give examples of motion.

3. Reporting and Discussion: Students reflect on the guessed words and relate them to the question "What is friction?" and "What are the characteristics of frictional force?"

4. Conclusion and Evaluation: The teacher concludes the activity and introduces question of the day.

Activity 2: Constructing new knowledge

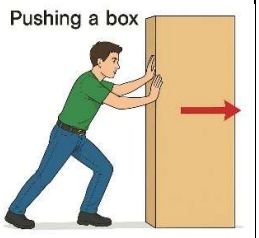
Sub-activity 2.1. Exploring static friction

***Aims**:* To identify what static friction is and describe its characteristics.

Instructional procedure:

1. Task Assignment:

- Students are divided into four groups to observe the image provided below. They then discuss and answer the following questions:



Q1: A man initially pushes a block with a small force, and the object remains at rest. Which force is responsible for resisting the motion of the object?

Q2: As the applied force increases and exceeds the value F_0, the block begins to move. What can you infer about the net force acting on the block at that moment?

- Have students analyze the characteristics of static friction.

2. Task Implementation: Students discuss and answer the questions:

Answer to Q1: The static friction between the block and the surface resists the motion of the block when it tends to move but has not yet moved.

Answer to Q2: When the object begins to move, the net force is no longer zero, and the applied force exceeds the maximum static friction.

Analysis: Static friction is parallel to the contact surface and occurs when the object tends to move relative to the surface but has not yet started moving. It acts in the opposite direction of the applied force.

3. Reporting and Discussion: The teacher calls two representatives to answer the question and analyze the characteristics of static friction.

4. Conclusion and Evaluation: The teacher comments on students' answers and concludes the concept and characteristics of static friction.

Sub-activity 2.2. The characteristics of sliding friction

***Aims**:* To explain the characteristics of sliding friction

Instructional procedure:

1. Task Assignment:

- Students review the concept of sliding friction learned in Grade 6.

- The teacher presents an image illustrating sliding friction, emphasizes that the two surfaces must be in contact, and helps students distinguish between contact and non-contact forces.

- Two additional images are shown to illustrate smooth and rough surfaces.

Have students discuss to answer the following questions:

Q3: What is sliding frictional force?

Q4: What is the direction of friction?

Q5: When moving on smooth and rough surfaces, which one is easier?

- Have students brainstorm the characteristics of sliding friction.

2. Task Implementation: Students discuss and complete the assigned tasks:

- Answer to Q3: Sliding frictional force is the force that opposes the relative motion between two surfaces in contact.

- Answer to Q4: Opposite to the direction of the relative motion.

- Answer to Q5: Movement on a smooth surface is easier than on a rough one.

- Characteristics: Sliding friction arises when two surfaces move relative to each other. It acts at the contact surface between the objects, opposing the direction of their relative motion.

3. Reporting and Discussion: The teacher invites two representatives from the four groups to present their responses to Q3, Q4, Q5, and then determine the characteristics of sliding friction.

4. Conclusion and Evaluation: The teacher summarizes and evaluates the outputs of each group's task performance, then synthesizes and concludes the key characteristics of sliding friction.

Sub-activity 2.3. The formula for sliding friction

Aims*:* To derive the formula for sliding friction

Instructional procedure:

1. Task Assignment:

- The teacher provides each group with the following equipment:

An inclined plane; Two marbles; A rough surface and a smooth surface; A dynamometer; Two wooden blocks with the same shape; Weight 1N, 2N; A small whiteboard to write results and conclusions.

- Have students conduct experiments to investigate the factors or quantities that affect the magnitude of sliding friction.

- Have students analyze the results to derive the formula for sliding frictional force.

2. Task Implementation:

- Students conduct the experiments guided by the teacher:

- Students engage in discussion to demonstrate their findings:

The frictional force depends on:

- The type of material and the surface roughness
- The magnitude of the normal force (directly proportional)

Frictional force does not depend on:

- The contact area between the objects
- The speed of the moving objects

The formula for sliding frictional force: $F_{friction} = \mu N$

where $F_{friction}$ is the magnitude of sliding frictional force; μ is the coefficient of friction (a dimensionless quantity); N is the magnitude of normal force (N).

The unit of frictional force is Newton (N).

3. Reporting and Discussion: The teacher has students perform their tasks and then determine the formula of sliding frictional force.

4. Conclusion and Evaluation:

The teacher concludes the formula of sliding frictional force and evaluates the activity. Students are reminded that the coefficient μ depends on the materials involved and the characteristics of the contact surface.

Sub-activity 2.4. The roles of friction in our daily life

Aims*:* To recognize some roles of friction in daily life

Instructional procedure:

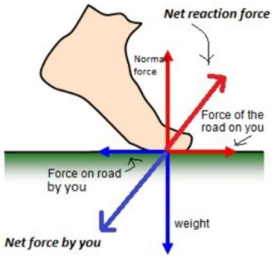
1. Task Assignment:

- Have students discuss to recognize whether friction can be helpful or harmful.

- Have students identify the role of friction in two contexts: A person walking; Gymnasts applying powder to their hands before lifting objects.

- Have students discuss how to reduce undesirable friction.

2. Task Implementation: Students discuss and complete the tasks:



- When you step forward, your foot exerts a backward force on the ground. According to Newton's Third Law, the ground exerts an equal and opposite forward force on your foot.

Role of Friction: Static friction between your foot (or shoe) and the ground prevents slipping and provides the necessary force to push your body forward.

- Gymnasts apply a coarse substance to increase friction, allowing their hands to grip or hold objects securely.

- To reduce harmful friction: use oils.

3. Reporting and Discussion: The teacher has students perform their tasks and evaluate the outcomes of the activity.

4. Conclusion and Evaluation: The teacher concludes and confirms the knowledge about the role of frictional force in daily life.

Activity 3. Practice

Aims: To apply acquired knowledge to answer multiple-choice questions related to friction.

Instructional procedure:

1. Task Assignment: Have students work individually and answer the question.

Q1: What kind of friction helps us to remain stationary on a slope?

A. Dry friction. B. Rolling friction. C. Sliding friction. D. Static Friction

Q2: The direction of sliding frictional force is _____ to the direction of motion.

A. same. B. opposite. C. parallel. D. perpendicular

Q3: The magnitude of friction is _____ to the magnitude of the normal force

A. inversely proportional. B. independent. C. directly proportional. D. equal.

Q4: A block of mass 20 kg is sliding across a horizontal wooden floor. The coefficient of sliding friction between the block and the floor is 0.3, and the gravitational acceleration is 10 m/s^2. Which of the following statements is correct? Which one is incorrect?

Statements	Correct/ Incorrect	
a) The normal force on the block is 20 N		
b) The frictional force acting on the block is 60 N		
c) The direction of frictional force is opposite to the direction of motion		
d) As the speed of the block increases, the magnitude of the frictional force also increases.		

2. Task Implementation:

Students answer the questions: 1 D; 2 B; 3 C; 4: I-C-C-I

3. Reporting and Discussion: The teacher invites students to answer the questions. Other students give feedback on their peer's responses.

4. Conclusion and Evaluation: The teacher comments and evaluates students' performance in completing the assigned tasks.

Activity 4. Application

***Aims**:* To explain the importance of friction materials in daily life contexts

1. Task Assignment: Have students watch a video of a song about friction, then explain why we need to use friction materials in shoes or the tires of wheels.

2. Task Implementation: Students watch the videos and explain why friction materials are crucial for safety and efficiency (provide grip and traction, preventing slips and skids).

3. Reporting and Discussion: Students discuss and perform their findings.

4. Conclusion and Evaluation: The teacher confirms the students' findings and concludes the activity.

6. Identifying assessment methods for learning activities	Assessment through Rubric: For example, assess Activity 4 based on the rubric (refer to the link https://byvn.net/EpuS).

Step 3. Revise the Lesson Plan

Guide students to evaluate the components of the lesson plan based on the assessment criteria. Any components that do not meet levels 2 or 3 (Satisfactory and Excellent) of the criteria should be revised to meet higher standards of the lesson plan evaluation criteria.

3. CONCLUSION

This paper presents a structured framework for guiding physics education students in developing lesson plans in English, highlighting key activities involved in designing each component of a lesson. One essential strategy is selecting subject-specific terminology to accurately describe the content of the lesson. By following the proposed procedure, students are given opportunities to repeatedly practice lesson planning and evaluate their products using defined criteria. As a result, they are exposed to a wide range of physics terminology across various topics, thereby enhancing their lesson-planning skills. The proposed procedure is instrumental in helping lecturers effectively guide students in designing and evaluating lesson plans, enabling students to clear understanding of the expected outcomes when creating a lesson plan. Ultimately, this contributes to improving the quality of training for physics education students who will teach physics in English.

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BIỆN PHÁP VÀ QUY TRÌNH HƯỚNG DẪN SINH VIÊN NGÀNH SƯ PHẠM VẬT LÍ XÂY DỰNG KẾ HOẠCH BÀI DẠY BẰNG TIẾNG ANH

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Tóm tắt: *Trong đào tạo cử nhân Sư phạm Vật lý dạy học bằng tiếng Anh, nội dung hướng dẫn sinh viên xây dựng kế hoạch bài dạy (KHBD) để dạy học vật lý phổ thông bằng tiếng Anh có vai trò quan trọng trong chương trình đào tạo, góp phần đạt được mục tiêu của chương trình đào tạo. Mục đích của nghiên cứu là đề xuất biện pháp và quy trình hướng dẫn sinh viên chuyên ngành Sư phạm Vật lý xây dựng KHBD. Để đạt được các nội dung này, nghiên cứu được tiến hành bằng cách đánh giá thực tiễn hướng dẫn sinh viên xây dựng KHBD và phân tích một số kết quả nghiên cứu về xây dựng KHBD để đưa ra quy trình hướng dẫn sinh viên xây dựng KHBD trong dạy học Vật lý phổ thông bằng tiếng Anh. Kết quả nghiên cứu đã chỉ ra các bước trong quy trình hướng dẫn sinh viên xây dựng KHBD, trong đó có nội dung quan trọng liên quan tới sử dụng các thuật ngữ chuyên ngành trong xây dựng KHBD và tổ chức dạy học. Nhờ đó, quy trình đã đề xuất có ý nghĩa quan trọng giúp giảng viên hướng dẫn và sinh viên xây dựng KHBD hiệu quả.*

Từ khóa: *kế hoạch bài dạy, sư phạm vật lí, dạy học bằng tiếng Anh, sinh viên sư phạm, thuật ngữ chuyên ngành.*

(Ngày Tòa soạn nhận được bài: 10-3-2025; ngày phản biện đánh giá: 21-3-2025; ngày chấp nhận đăng: 16-4-2025)