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PROPOSED CRITERIA FOR SELECTING CONTENT TO TRAIN PHYSICS PEDAGOGY STUDENTS IN DEVELOPING BLENDED LEARNING LESSON PLANS

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Abstract. Selecting content is one of the crucial steps in equipping physics pedagogy students with the ability to develop Blended learning lesson plans (BLLP). The purpose of this study is to propose criteria for selecting training content for physics pedagogy students to develop BLLP for teaching physics by Vietnam's general education curriculum. To achieve this, the research team analyzed the learning outcomes and content of professional pedagogical knowledge modules in the training programs of physics pedagogy students from two education universities, the content of teaching physics according to Vietnam's general education curriculum, the characteristics of Blended learning (BL) and seeking expert opinions on criteria for selecting content, and training content. The research results include the five criteria identified, the five areas of training content for physics pedagogy students in developing BLLP. This content is related to the structure and use of BL models, creating an online learning environment in teaching physics in high schools, and designing teaching activities both in-class and online according to the BL model. The research findings contribute to the development of content for training physics pedagogy students to construct BLLP and effectively apply BL in teaching physics in high schools.

Keywords: criteria for selecting training content, blended learning lesson plans, physics pedagogy, curriculum.

1. Introduction

BL, a method that integrates both face-to-face and online learning, has gained significant attention in recent years due to its potential to offer flexible learning opportunities. According to Michael Horn, Heather Staker (2017), BL is defined as "any formal education program in which a student learns at least in part through online learning, with some element of student control over time, place, path, and/or pace". The second part of the definition is that the student learns at least in part in a supervised brick-and-mortar location away from home. The third part of the definition is that the modalities along each student's learning path within a course or subject are connected to provide an integrated learning experience [1]. There is evidence that BL has a positive impact on student outcomes, and BL promotes the development of essential 21st-century skills such as critical thinking, collaboration, and problem-solving [2]. Students are free to learn subject matter independently by utilizing material available online, and students can discuss with teachers or other students without having to be present in class (face-to-face) [3]. Using a flipped classroom

(one of the BL models) helps learners improve critical thinking skills, feel more confident, improve application skills, and improve ICT skills [4].

In a study on content selection, Nguyen TMN proposed several criteria for choosing appropriate teaching materials. These include aligning content with educational goals, considering the psychological and physiological characteristics of students [5]. The criteria for the proportion between the content and the scientific principles of curriculum are as follows: 1. The proportion between the content and the philosophical principle of curriculum; 2. The proportion between the content and psychological principles [6]. Criteria for selecting content in primary science is often epitomised as the choice of what is 'close' to students [7]. When selecting teaching content, some of the criteria should be used: Self-sufficiency, Significance, Validity, Interest, Utility, Learnability, and Feasibility [8].

Content selection is the fulcrum of curriculum planning and one of the most important professional decisions educators make [9]. The content must be concise, accessible, foundational, modern, practical, and applicable to real-world scenarios [10]. According to Geir Johansen, when selecting content, the following should be considered: 1. The content should contain exemplary values; 2. The content should have significant relations to students' backgrounds; 3. The content should be significant for students' futures; 4. The elements, layers, contexts, and results criteria of the content should be structured; 5. The special sides of any content that can make its structure approachable for our students should be noted [11]. Some checklists for selecting content for learning are: 1. Select an area of the student's interest; 2. Reframe interests into activities and experiences: 3. Include experiences and activities [12]. When selecting content, use the directions: 1. Compare your course description with the official course description in the university's course calendar; 2. If you are offering a pre-existing course, check with your department for previous course outlines 3. If your course is new, compare what you are planning to similar courses at other institutions; 4. Include only content that supports the learning outcomes; 5. As an alternative to a traditional textbook, consider using an Open Educational Resource (OER [13].

Thus, while several studies have detailed the criteria for selecting teaching content, there is a lack of established criteria for selecting training content specifically for physics pedagogy students to develop BLLP. The objective of this study is to propose criteria for selecting appropriate teaching content to guide the development of BLLP for physics education students. These criteria will then be applied to choose suitable content aligned with the objectives of the training program. To achieve this goal, the research addresses two questions: (1) What criteria should be used to select content for training physics students to develop BLLP? (2) What content should be developed to train physics pedagogy students in constructing BLLP?

By using these criteria to select training content, this research will assist educators in choosing the appropriate material to help students develop BLLP. Additionally, it provides a useful reference for teachers of physics or natural sciences in organizing BL-based instruction.

2. Content

2.1. Literature review

2.1.1. The process of curriculum development

Taba believed that a curriculum should be designed by its users. Teachers should begin by creating specific teaching-learning units for their students and then build to a general design. Taba's grassroots model entails seven major steps [8]: Step 1. Diagnosis of needs: The teacher (acting as a curriculum designer) identifies the needs of the students for whom the curriculum is being developed; Step 2. Formulation of objectives: The teacher specifies objectives; Step 3. Selection of content: The objectives suggest the curriculum's content. The objectives and content

should match. The content's validity and significance must also be assessed; Step 4. Organization of content: The teacher arranges the content sequentially, considering students' maturity, academic performance, and interests; Step 5. Selection of learning experiences: The teacher chooses instructional methods that actively engage students with the content; Step 6. Organization of learning activities: The teacher organizes the learning activities into a sequence, often determined by the content; Step 7. Evaluation and means of evaluation: The teacher determines which objectives have been accomplished. Both students and teachers should engage in the evaluation process.

Thus, in Taba's process, content selection is an essential step in curriculum development, ensuring that the teaching content helps students achieve the training objectives. The author studies steps 1, 2, and 3 to identify the needs, objectives, and content for training physics education students to design BLLP.

2.1.2. The process of training students to design blended learning lesson plans

By applying certain steps from Taba's curriculum development process, the author proposes the steps in the process for training students to design BLLP: Step 1. Identifying Training Needs: Based on the analysis of content in the physics teacher training curriculum and the current state of high school physics teaching, with the increasing integration of ICT, it is evident that there is a need to train students to design BLLP. Step 2. Identifying Training Objectives: 1. Present the concept of BL and identify various BL models. 2. Analyze the characteristics of these models. 3. Describe the conditions and methods for using BL models and assessment techniques in physics teaching at the high school level. 4. Design an online learning environment for teaching high school physics. 5. Create a BLLP. 6. Evaluate and adjust the BLLP. Step 3. Selecting Training Content: The training content must help students achieve the outlined objectives. The content is selected based on specific criteria. Step 4. Digitizing the Training Content: Convert the training content into E-learning lessons and electronic materials for online delivery. Step 5. Developing Evaluation Criteria for Students' Lesson Plans: The evaluation criteria are categorized into a rubric to assess the quality of the BLLP. Step 6. Organizing the Training: Training will be conducted through a combination of online and face-to-face methods. Step 7. Evaluating and Adjusting the Training Process: Evaluate the results of the training in order to adjust the objectives, content, and activities of the training.

In this process, Step 3 requires selection criteria to choose appropriate content that enables students to construct BLLP. This article will clarify the content of training in Step 3.

2.1.3. Lesson plans and blended learning lesson plans

A lesson plan is a teacher's detailed description of the course of instruction for an individual lesson. Most lesson plans contain some or all of these elements, typically in this order: 1. The title of the lesson. 2. The amount of time required to complete the lesson. 3. A list of required materials. 4. A list of objectives. 5. The set or lead-in to the lesson. 6. The instructional component. 7. Independent practice. 8. The summary. 9. Evaluation. 10. Analysis [14]. According to the Ministry of Education and Training's Circular No. 5512, the structure of a lesson plan includes key components such as learning objectives, teaching resources, and student activities [15]. A lesson plan serves as a proposed script designed by the teacher, detailing all tasks for both the instructor and students on a particular lesson topic [16]. In a lesson plan, the teacher must identify objectives, consider assessment methods, sequence the teaching content, and organize each activity [17]. A lesson plan includes activities of teachers and students during the teaching of a lesson/topic to help students achieve learning objectives [18]. The success of a lesson plan relies on integrating three core elements: learning objectives, student activities, and assessment methods [19].

Research on BLLP, research by S. Roberts (2020) and T. L. Kieu, et al., (2024) indicates that, in addition to the basic components like lesson title, duration, and learning objectives, it is

essential to clearly outline: print materials (physical resources for instruction), digital materials (online instruction for support and differentiation), assessment (what the students will do independently to show mastery of the content covered in the lesson) and list of activities (Including Objective of activity, Digital Content, Print Content): Warm-Up and Lesson Introduction, Instructor Modeling and Guided Practice, Independent Practice, Wrap-Up, Reflection, and Extension [16], [20].

Thus, the structure of a BLLP must reflect the learning materials used, activities both in-class and online, and the online environment that supports teaching activities. Based on this analysis, it is necessary to identify the training content that will enable students to build a BLLP with this structure.

2.1.4. The process of designing a blended learning lesson plan

Researching the process of designing a BLLP helps to identify the content required to meet the stages of BLLP development. According to the author T. L. Kieu and colleagues [16], the process of designing a BLLP consists of the following steps: Step 1. Identifying Required Achievements and Online/Offline Teaching Content: Select the online teaching content based on the identified achievements. Select the offline teaching content based on the outcomes that need to be achieved through direct instruction; Step 2. Identifying and Developing Online and Offline Learning Resources: Online Learning Resources (Preferably use digital resources such as tutorial videos, e-learning lectures, e-textbooks, software, etc.). Offline Learning Resources (Use traditional materials such as textbooks, exercises, and experimental tools, etc.); Step 3. Designing Teaching Activities and Assessment for Online and Offline Learning: Online and offline activities must be interconnected and form a logical sequence to help students accomplish the given tasks. Generally, online learning focuses on knowledge acquisition, while offline learning includes practical activities such as conducting experiments and applying knowledge.

For students to be able to execute the steps of this process, the training content must equip them with the fundamental knowledge and skills of BL models, the ability to design in-class and online activities, and the capacity to create an online learning environment.

2.2. Methodology

The research was conducted through the following steps:

Step 1. Study of the reality of physics teaching and the physics teacher training curriculum: This step involves studying the reality of high school physics teaching and the goals and content of the physics teacher training curriculum at Hanoi National University of Education (HNUE) and Hanoi Pedagogical University 2 (HPU 2). The purpose is to identify the needs for training and the content that will support students in designing BLLP; *Step 2.* Proposing the training process for students to design BLLP: In this step, the research proposes the steps involved in training students to design BLLP. The aim is to meet the training requirements and the content to be covered in the program; *Step 3*. Proposing criteria for selecting content for training students to design BLLP: This step involves researching the criteria for selecting teaching content to propose the criteria for training students to design BLLP; *Step 4.* Selecting training content based on the criteria: Based on the established criteria, this step involves selecting training content that aligns with the training objectives and goals; and *Step 5*. Seeking expert opinions on criteria for selecting content and training content: In this step, experts who are physics education instructors with doctoral degrees are selected to provide feedback on the content for training students to design BLLP. Expert consultation was conducted in three rounds using the eDelphi method (evaluation forms were created on Google Forms) with the same group of experts. In Round 1, experts rated items on a 5-point Likert scale (from 'Strongly Disagree' to 'Strongly Agree') and provided feedback through open-ended questions. Items with a consensus rate of 75% or higher were retained for Round 2. Items with a consensus rate between 50% and 74% were revised and included in Round 2. Items

with a consensus rate below 50% were eliminated. Open-ended questions were used to develop or revise items. In Round 2, experts re-evaluated the items on a 5-point Likert scale. Items with a consensus rate of 75% or higher were included in the competency framework, while those with a consensus rate between 50% and 74% were revised for Round 3. In Round 3, experts rated the revised items on a 5-point Likert scale, and items achieving a consensus rate of 75% or higher were finalized for inclusion in the competency framework [21].

2.3. Results

2.3.1. Analysis of the curriculum for physics teacher training programs

Analysis of the physics teacher training program at HNUE [22] and HPU 2 [23] reveals that the curriculum for pedagogical courses (such as those related to the high school physics curriculum, teaching methods, ICT use in physics education, E-learning in physics, and physics experiments, Assessment in Physics Teaching and Learning) helps students define objectives and content for teaching, use teaching equipment and materials (multimedia, traditional and digital resources), as well as software tools like interactive simulations and video analysis; Design teaching activities and assessment plans. Online teaching in the optional courses (at HPU 2) or mandatory ones (at HNUE). However, the instruction on designing BLLP is not specifically covered in the courses. So, the training content necessary for students to design BLLP includes the following: Choosing a BL Model, Assessment Methods in BL, Applying IT (Creating Learning Environments, Using IT Products for Assessment, Using IT Products for teaching and learning), Designing Basic Learning Activities for Competency Development (How to design BL activities that complement each other in a logical sequence). The following training content is not included, as students have already learned it in other courses: Analyzing and Understanding the Curriculum and Textbooks, Defining Learning Objectives and Content, Preparing Teaching Aids and Equipment, Selecting Learning Resources (videos, images, simulation software, video analysis software), On selecting teaching methods and techniques, Revising/Improving BLLP.

2.3.2. Criteria for selecting training content

Based on the criteria for selecting teaching content and the training objectives, criteria for selecting training content for physics pedagogy students to develop BLLP were proposed. These criteria were submitted for expert review over two rounds. The expert panel consisted of six PhDs in the theory and methodology of teaching physics, currently working at different universities with over 10 years of experience. The results of the two rounds are presented in Table 1.

Table 1. Expert Opinions on criteria for selecting training content

No.	Content for Feedback	Round 1			Round 2		
		Mean	***SD***	***Consensus Rate (%)***	***Mean***	***SD***	***Consensus Rate (%)***
1	Alignment with Program's Learning Outcomes	4.8	0.41	100%	4.8	0.41	100%
2	Alignment with the 2018 Physics Curriculum Teaching Guidelines	4.5	0.55	100%	4.5	0.55	100%
3	Suitability for Student Level	4.7	0.52	100%	4.3	0.52	100%
4	Open Learning Resources	4.3	0.52	100%	4.3	0.52	100%
5	Up-to-date Content	4.5	0.55	100%	4.7	0.52	100%

As a result, after two rounds, all proposed criteria received an agreement rate of over 75% from the experts. Based on these results, the criteria are as follows:

- Criterion 1. Alignment with Program's Learning Outcomes: In the physics teacher training

curriculum at HPU 2, the learning outcome is described as "Effectively organizing activities that develop students' qualities and competencies through physics teaching and other educational activities at the secondary school level" [23]. Therefore, when proposing training content, it must align with the program's learning outcomes and focus on BLLP that help students apply physics teaching in high school to enhance students' physics competence.

- Criterion 2. Alignment with the 2018 Physics Curriculum Teaching Guidelines: The teaching guidelines in the 2018 physics curriculum emphasize "applying and utilizing the advantages of information and communication technology (ICT) and experimental equipment in organizing student learning activities, searching for and collecting information through books, the internet, and multimedia resources to explore the natural world and apply knowledge" [24]. Thus, it is necessary to guide students in designing BLLP that leverages ICT in physics teaching.

- Criterion 3. Suitability for Student Level: The training is aimed at third- and fourth-year students who have already studied key content such as teaching theories, using physics teaching software, analyzing teaching content, and assessment methods. Therefore, the proposed content should not overlap with previously studied courses (as analyzed in Section 2.3.1). Additionally, the content must be appropriate for students' abilities, enhance self-directed learning, and help students design BLLP.

- Criterion 4. Open Learning Resources: Open educational resources that are easily accessible, such as YouTube videos and simulation websites like https://phet.colorado.edu and https://ophysics.com/index.html, were chosen. These resources are suitable for the teaching content and help students achieve learning goals. Moreover, these resources are easy to use and can be integrated into LMS or e-learning platforms.

- Criterion 5. Up-to-date Content: The training content on using BL in physics teaching was compiled from materials published in the last 10 years. The software tools for simulations, videos, and LMS platforms are widely used in current educational practices.

2.3.3. Training content

After selecting the training content based on the criteria, expert opinions were solicited to refine the content. The selected experts included five PhDs in the theory and methodology of teaching physics and one expert with a PhD in information technology (with experience in teaching methodology). The experts are currently working at pedagogical universities and have more than 10 years of professional experience. The detailed training content was sent to the experts along with the evaluation form. The result in Table 2.

Table 2. Expert Opinions on Training Content

No.	Content for Feedback	Round 1			Round 2		
		Mean	***SD***	***Consensus Rate (%)***	***Mean***	***SD***	***Consensus Rate (%)***
1	Training content aligns with training objectives	4.8	0.41	100%	0.52	4.7	100%
2	Training content helps students design BLLP	4.7	0.52	100%	0.41	4.8	100%
3	Training content is new and updated	4.8	0.41	100%	0.52	4.7	100%
4	Training content is suitable for physics teacher training	4.5	0.55	100%	0.00	5.0	100%
5	Training content is scientifically sound	4.5	0.55	100%	0.52	4.7	100%

Regarding the question, "Which aspects of the content need revision?", the experts provided the following feedback: Expert 2 and Expert 3 suggested clarifying certain training content and terms used. Expert 5 recommended adding guidance on how to organize online learning activities. For the question, "What additional training content should be included?", experts offered the following suggestions: Expert 5 recommended including methods for receiving feedback from both instructors and other students for Content 4. Expert 6 proposed adding content about online assessment and analyzing results to support setting goals and designing classroom teaching content. The selected training content was refined according to the proposed criteria and expert feedback. The training content includes:

Content 1. BL in Physics Education: definition, models of BL, advantages, and limitations of BL; assessment in BL; guidance on selecting a suitable BL model for physics teaching; guidelines for designing classroom and online teaching activities.

Content 2. Designing an Online Learning Environment: integrating simulations (such as on https://phet.colorado.edu, https://ophysics.com/index.html) into e-learning lessons/LMS/Google Classroom; creating e-learning videos or SCORM modules (using software like iSpring Suite) and uploading them to LMS/Google Classroom; using software tools for online assessment; managing student lists on LMS/Google Classroom.

Content 3. Theoretical Framework for Designing BLLP: the process of designing BLLP; designing classroom and online learning activities on paper; assigning tasks to students through LMS/Google Classroom; organizing online teaching activities; assessment in BL; theory of Lesson Study methodology.

Content 4. Criteria for Evaluating BLLP: a system of criteria and evaluation levels using a rubric for students to assess BLLP; how to use evaluation results.

Content 5. Physics Lessons for Students to Practice Designing BLLP: teaching physics content that provides opportunities for classroom activities involving physics experiments, device models, and online environments that use simulations and videos. These lessons include free fall, projectile motion, harmonic oscillation, and an introduction to waves. An analysis of the detailed content was conducted to evaluate its alignment with the proposed criteria. The alignment of the content with the criteria described in Table 3.

Table 3. Content alignment with criteria

No.	**Content**	**Criterion**				
		Criterion 1	***Criterion 2***	***Criterion 3***	***Criterion 4***	***Criterion 5***
1	Content 1	x		x		x
2	Content 2	x	x	x	x	x
3	Content 3	x	x	x		
4	Content 4	x	x			
5	Content 5	x	x	x		

The training content to meet the training objectives (described in Section 2.1.2): Content 1 supports students in achieving objectives 1, 2, and 3; Content 2 supports students in achieving objective 4; Content 3, 4, and 5 support students in achieving objective 5; Content 4 supports students in achieving objective 6. The training content is provided to students in the form of electronic documents and e-learning lessons. The training is organized into five activities: Activity 1: studying the illustrative BLLP; Activity 2: learning about BL knowledge (example of the lesson at the link: https://byvn.net/N5ln); Activity 3: explaining the illustrative BLLP; Activity 4: creating a BLLP; Activity 5: evaluating and adjusting the BLLP.

2.4. Discussion

The proposed training content in this article aims to supplement the knowledge and skills that physics education students need to create BLLP. The content is aligned with the direction of using BL in teaching, as outlined in several published studies. For instance, Desiree Tan, et al. (2020) suggest organizing learning so that new knowledge is acquired through online lectures, followed by practice and exercises in the classroom [25]. Similarly, S S Amanah, et al. (2021) argue that the best approach is not to dedicate class time to lecturing or direct theoretical instruction. Instead, students should acquire knowledge before the class, leaving in-class time for application and creative activities [26]. According to Desiree Tan, et al. (2020), the main stages of BL involve introducing learning tasks, students learning theoretical content online, performing assessments before class, and applying knowledge in the classroom [25].

The proposed training content on using BL in physics education is both current and relevant, aligning with recent research on the use of BL in teaching. It describes classroom activities that prioritize using experimental equipment, physical models, and product reporting, while online activities focus on learning through e-learning lectures, searching for information on the web, and using online software [3], [16], [27]-[30]. Online learning activities are a mandatory requirement for students to connect with in-class learning, where students learn through video lectures accompanied by audio recordings and PowerPoint presentations [31]. These directions are summarized in Table 4.

Table 4. Guidelines for face-to-face and online physics teaching activities

Face to face	Online
Learning new knowledge through direct lectures by the teacher.	Learning theoretical content through e-learning lectures and digital resources.
Conducting physics experiments, exploring device models (e.g., electric generator).	Using software and videos (to explore phenomena and applications of physics knowledge).
Completing exercises after learning theoretical content online.	Searching for information about physics knowledge, phenomena, and applications.
Working in groups for project-based activities.	Using AI tools.
Reporting products for teacher feedback and evaluation.	Discussing in groups when completing tasks and submitting results.
Evaluating learning through paper-based tests.	Evaluating learning through online assessments.

3. Conclusions

The system of proposed criteria plays an important role in guiding the selection of training content for physics education students to design BLLP. These criteria are based on the analysis of content selection criteria, the characteristics of BLLP, and the content of the physics teacher training program. The main research results include a system of 5 criteria for selecting content and 5 types of training content for physics pedagogy students in developing BLLP for teaching physics in high schools. The criteria clearly describe the requirements for selecting content that meets the learning outcomes of the program, students' abilities and needs, the direction of high school physics teaching, and the use of open and up-to-date learning resources.

Based on these criteria, the training content has been selected to supplement the gaps in the physics teacher training curriculum. The training content related to the use of information technology needs to be continuously updated to keep pace with changes in technological products. In the training process, these materials should be converted into electronic documents and e-learning lessons to enhance self-directed learning and organize training in a BL model.

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