Journal of Innovative Physics Education Research (JIPER)
e-ISSN: 3089-5006 *Vol. 1 No. 1, April 2025, Page 15-20*

Development of Physics Module on Catfish Farming To Foster Students' Entrepreneurial Behaviour

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Received January 10, 2025; Revised January 30, 2025; Accepted March 26, 2025; Available online March 26, 2025
DOI: https://doi.org/10.61142/jiper.v1i1.193

Keywords :
Module,
Static Fluid,
Catfish Farming,
Entrepreneurial Behavior,
Contextual Approach

ABSTRACT
This study aims to develop a physics learning module based on catfish farming as a contextual approach to teaching static fluid concepts. The module was designed using the 4-D development model (Define, Design, Develop, Disseminate) to enhance students' learning interest and foster entrepreneurial behaviour. The module was evaluated by material and media experts, achieving an average score of 87.90%, indicating a high feasibility level for use. Trial tests with students yielded an average score of 83%, reflecting very positive responses. The module not only aids students in understanding physics concepts more effectively but also promotes critical thinking, innovation, and entrepreneurial skills. By integrating physics with real-world applications such as catfish farming, the contextual approach offers meaningful and relevant learning experiences connected to daily life.

INTRODUCTION

Static fluid is one of the branches of physics that is often a challenge for students. Ringo et al. (2019), research shows that this difficulty is caused by learning methods that are less contextualized and tend to be one-way, making it difficult for students to understand the concept of static fluid in depth. This material should not only be limited to mathematical calculations but also linked to everyday life [2].

Since the 1970s, students' difficulties in understanding basic physics concepts, including static fluid, have been a concern [3]. Students often have problems understanding hydrostatic pressure, Pascal's law, and buoyancy force in Archimedes' law [4-6]. These concepts are abstract and, therefore, difficult to imagine, such as hydrostatic pressure related to the fluid's force on a submerged object or buoyancy force, which acts on the weight of the displaced fluid.

Other challenges involve applying complex mathematical formulae, including pressure, volume, density and force [7]. Previous research suggests more effective teaching approaches, such as using visual models, hands-on experiments and real-world applications to clarify students' understanding. In addition, students' weak knowledge structure and monotonous learning methods also complicate understanding. Fun and contextualized approaches, including relevant experiments are an important focus.

The implementation of Merdeka Curriculum in Indonesia encourages changes in learning approaches with a focus on developing soft skills, student character, and essential materials. This curriculum allows educators to design flexible and context-based learning so that the teaching materials developed can improve cognitive abilities while honing relevant skills for real life. Contextual learning links academic material to real-life situations, so learning becomes more meaningful. Contextual learning helps students understand the connection between theory and practice. This approach fulfills the demands of the Merdeka Curriculum, helping students understand physics concepts in an applicable manner and relevant to everyday life.

This research aims to explore and develop a more effective learning approach to teaching static fluid concepts to students. This approach is expected to overcome students' difficulties in understanding basic physics concepts, such as hydrostatic pressure, Pascal's law, and buoyancy force in Archimedes' law. In addition, this research aims to relate static fluid material to the context of everyday life, using visual models, hands-on experiments, and real-world applications that follow the Merdeka Curriculum. With this contextual approach, students are expected to understand the relationship between theory and practice and develop cognitive and soft skills that are relevant to real life.

METHOD

This research aims to develop an integrated physics module of entrepreneurial behaviour using a research and development (R&D) approach with the 4-D method (Define, Design, Develop, Disseminate). At the **Define stage**, a needs analysis and literature study was carried out to identify challenges in catfish cultivation and its conformity with the Independent Curriculum of High School in physics. The **Design stage** includes designing an entrepreneurship module that combines physics principles (e.g., fluid dynamics for water circulation systems and thermodynamics for pool temperature management) with a business strategy based on entrepreneurial behaviour [11, 12]. The **development stage** includes the preparation of module content, prototyping, validation by material and education experts, and experiments on six catfish ponds with variations in depth and exposure to sunlight. Furthermore, the **dissemination stage** involves testing the module's effectiveness by training business actors and evaluating its impact on production efficiency.

The final product of the research is a physics-based catfish cultivation entrepreneurship module equipped with practical guides and case studies. This module is designed to improve the efficiency of the catfish growth cycle through the application of physical science, but also in line with the Independent High School Curriculum, which prioritizes contextual learning. Thus, this module can be a relevant learning resource for prospective entrepreneurs in facilitating the development of entrepreneurial behaviour, such as confidence, originality, and risk-taking.

The subject of the study involved 10 students of SMA Negeri 1 Cikande as respondents. They were given a physics-based entrepreneurship module to test their responses. Data is collected through questionnaires and expert assessment sheets to assess the feasibility of the module and student responses. Data analysis was carried out using a percentage technique and was categorized into five levels: very good, good, moderately good, poor, and very poor.

RESULTS AND DISCUSSIONS

Students' low interest in physics is the main problem found in this study. The problem was triggered by several factors, including teaching methods that only focus on textbooks, lack of interaction between teachers and students, and lack of application of real-life-based learning. To overcome this problem, the researcher developed a contextual learning module that links physics with catfish farming. The purpose of developing this module is to increase students' interest in learning while fostering their entrepreneurial attitude.

The module development was conducted using the 4-D model, which consists of four stages. In the Define stage, researchers conducted an initial analysis to identify learning problems, student characteristics, and learning needs on static fluid physics material. The observation showed that conventional teaching methods did not attract students' attention. Furthermore, concept analysis was conducted to develop learning based on catfish farming entrepreneurship relevant to the static fluid concept.

At the Design stage, the module was designed in A4 print format for easy access by students. The module consists of three main sections: ' Observe and Research', 'Let's Calculate', and 'Let's Think'. The 'Observe and Research' section aims to train students' analytical skills through direct observation, such as understanding the importance of light intensity in the growth of algae in fish ponds. The 'Let's Calculate' section is designed to train problem-solving skills with relevant physics calculations, such as light flux and water temperature. Meanwhile, the 'Let's Think' section encourages students' creativity through group tasks that involve designing catfish ponds and developing aquaculture technology.

Fig1. Physics Module on Catfish Farming to Nurture Students' Entrepreneurial Behaviour

The development stage was conducted to ensure the quality of the module before it was applied to learning. The module validation was performed by two experts, namely physics lecturers and high school physics teachers, resulting in an average score of 87.90% with a very good category. The module was also tested with students to get further input. Based on input from experts and students, researchers revised the module by improving the sentence structure, numbering, and instructions for using the module to make it better and feasible.

Table 1. Results of Expert Assessment Questionnaire

Assessment Criteria	Score Assessment	Category Score
Presentation feasibility	84.17%	Very Good
Language Feasibility	88.33%	Very Good
Desain Kulit Modul (Cover)	91.25%	Very Good
Module Skin Design	87.83%	Very Good
Total Average	**87.90%**	**Very Good**

The last stage, Disseminate, is done by implementing the module to students through direct learning. The assessment was conducted using a questionnaire, resulting in an average score of 83% with a very good category. This result shows that this learning module can help students understand physics concepts, attract their attention, and be relevant to everyday life [13].

Table 2. Student Questionnaire Score Results

Item assessment	Score	Category Score
I believe that physics entrepreneurship course is very important for physics education students.	84 %	Very good
I feel that this physics-based entrepreneurship module can help my understanding in learning physics entrepreneurship.	88%	Very good
I believe this physics-based entrepreneurship module can motivate me to learn more about physics entrepreneurship.	80%	Good
I find this physics-based entrepreneurship module easy to learn and understand.	74%	Good
I find that this physics science-based entrepreneurship module uses language that is easy to understand.	86%	Very good
I believe this physics-based entrepreneurship module helps me understand the concepts in physics entrepreneurship.	74%	Good
I find this physics-based entrepreneurship module interesting and encourages me to start entrepreneurial activities.	78%	Good
I feel this physics-based entrepreneurship module makes me excited and enthusiastic.	92%	Very good
I believe this physics-based entrepreneurship module is not boring and does not make me sleepy.	82%	Very good
feel that this physics-based entrepreneurship module provides real examples that are relevant to be applied in everyday life.	92%	Very good
Total Score	**83%**	**Very good**

The development of teaching methods based on contextual learning modules is proven to be a solution to increase students' interest and understanding of physics lessons. This module provides knowledge about static fluid and trains students' entrepreneurial skills through activities such as catfish farming [14,15]. This approach makes learning more interesting as it connects physics concepts with practical applications in everyday life.

Module sections such as 'Observe and Research' are designed to train students in analytical thinking, while 'Let's Calculate' helps students practice problem-solving skills with a fundamental case-based approach. The 'Let's Think' section develops students' creativity through collaboration in designing and managing fish farming. Expert and student assessments indicated that the module was of excellent quality regarding design, language, and content.

The application of the 4-D model provides a systematic and practical framework for producing relevant and engaging learning modules. This module makes physics learning more contextual and meaningful, so students are more motivated to learn [16]. This approach also has the potential to be applied to other materials in physics learning in the future [17].

CONCLUSION AND SUGGESTION

The development of learning modules with a catfish farming approach has been proven to help increase student interest and involvement in learning physics. The development process was carried out in stages using the 4-D model (Define, Design, Develop, Disseminate) so that this module can better meet the needs of students. The expert assessment results showed that this module is of very good quality, with an average score of 87.90%. Meanwhile, responses from students were also very positive, with an average score of 83%. This module helps students understand the physics material better and motivates them to learn through a practical and relevant approach. Using real contexts, such as catfish farming, makes learning more interesting and valuable for students.

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