



Systems thinking in physics learning process

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ABSTRAK

Pembelajaran yang berkualitas adalah proses pembelajaran yang didasarkan pada hasil evaluasi. Salah satu evaluasi proses pembelajaran adalah pendekatan berpikir sistem. Penelitian ini bertujuan untuk mengetahui kendala proses pembelajaran dengan pendekatan berpikir sistem dan menentukan strategi pemecahan masalah untuk meningkatkan kualitas proses pembelajaran. Metode penelitian yang digunakan adalah metode deskriptif kualitatif dan *group model building*. Hasil penelitian menunjukkan bahwa variabel objektif proses pembelajaran adalah pemahaman siswa. Variabel pendukung untuk lebih memahami materi perkuliahan adalah kreativitas dosen.

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ABSTRACT

Systems thinking in physics learning process. Quality learning is a learning process based on the evaluation results. One of the evaluations of the learning process is the systems thinking approach. This study aims to determine the constraints of the learning process with systems thinking approach and determine problem-solving strategies to improve the quality of the learning process. The research method used is a descriptive qualitative method and group model building. The study results show that the learning process's objective variable is student understanding. The supporting variable to better understand the lecture material is the creativity of the lecturer.

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Introduction

A quality learning process is a learning process that is developed based on the results of the evaluation. Learning is a process carried out by a person to get a change in himself as a whole, a change in behavior in the individual due to interactions between individuals and other individuals as a result of an experience in interacting with their environment (Mulyati & Guntarsih, 2018; Suryana, 2020; Wandini & Sinaga, 2018). Learning is a process of regulating, providing guidance or assistance to students, and organizing the student environment to grow and encourage students to carry out learning activities (Pane & Dasopang, 2017).

The learning process can be successful if learning objectives are achieved. Learning objectives describe students' abilities that show the performance of knowledge, skills, and attitudes that enable students to learn and perform tasks and functions determined to be achieved as learning outcomes (Hendratmoko et al., 2017). However, in achieving learning objectives, there are always problems encountered. The problems that generally occur result in achievements that deviate from the initial goal, curriculum problems, and teacher quality (Rohman, 2009). According to Suryana (2020), other learning problems are internal and external conditions. Internal conditions include teachers, materials, interaction patterns, media, technology, learning situations, and systems. External conditions affect such as the environment around the learning process. Meanwhile, Fadilla (Fadilla et al., 2021) classifies problems into internal and external problems. Internal problems are problems that arise from students, such as health, intellectual ability, motivation, age, gender, and social background. In comparison, external problems are problems that arise from outside students. The physics learning process still has many difficulties, especially in understanding basic physics material, so it is necessary to carry out comprehensive problem analysis to create innovative physics learning strategies (Elisa et al., 2017).

Evaluation of the learning process is currently still looking at the value of learning outcomes, evaluation of the learning process from cognitive, psychomotor, and affective factors is still done partially so the evaluation process is not comprehensive (Pane & Dasopang, 2017). Problems in the learning process need to be linked to see the interrelationships between the problem variables to create a comprehensive problem-solving strategy. The innovation that can be done to evaluate the learning process is by using the systems thinking approach (Casnan, Triwahyuni, et al., 2022). The evaluation process with systems thinking approach can formulate various problem-solving strategies in the learning process to improve the quality of the current and future learning process.

Method

A descriptive qualitative approach and group model building were employed for the research (Browne et al., 2021). Analytical techniques based on qualitative research are created without statistical analysis or other quantification techniques (Casnan, Purnawan, et al., 2022). Data in qualitative research

is descriptive in the form not in the form of numbers. The data obtained are general symptoms, events, and events that are analyzed in the form of classification. The results of qualitative research do not come from other kinds of calculations. Inductive data analysis, several data gathering methods, and the researcher acting as a primary instrument are all characteristics of qualitative research (Latar & Rummahlewang, 2020). The goal of the descriptive qualitative approach is to examine, characterize, and sum up different conditions and scenarios using information gathered from interviews or observations regarding the issue (Widiastuti et al., 2022). Researchers emphasize notes with detailed, complete sentence descriptions to describe the actual situation to support data presentation (Heong et al., 2020).

Group Model Building is a way to solve problems that require several alternative answers and can be close to the actual truth. GMB or Group Model Building is one way to get involved in developing a system (Casnan, Triwahyuni, et al., 2022). Some opinions from experts and stakeholders involved in the learning process can be used as a reference for evaluating the learning process with systems thinking approach.

Results and Discussion

Based on the research that has been done, the problems in the physics learning process through the systems thinking approach are learning media, lecturers, learning methods, environment, and self-motivation. The problem is divided into 2 classifications, namely the objective variable and the supporting variable. The objective variable consists of the learning process that can affect student understanding, while the supporting variable so that students understand the lecture material is through the creativity of a lecturer. The variables that become the problem are shown in Figure 1.

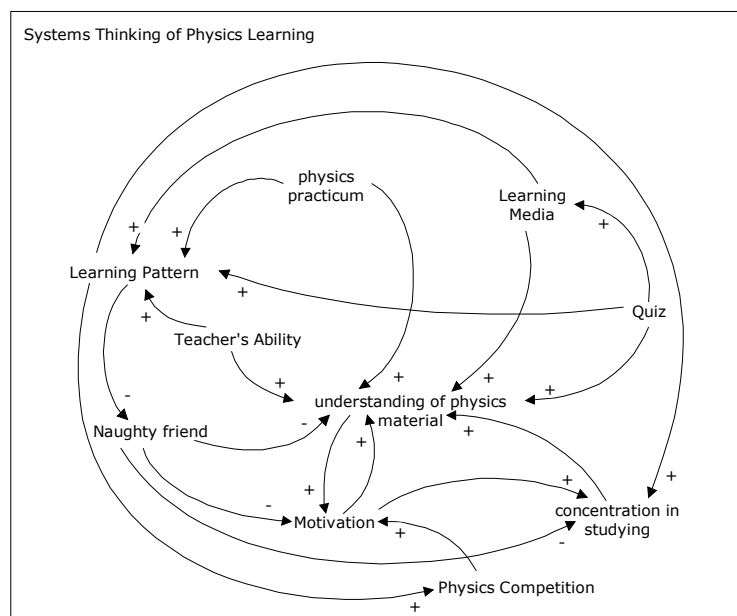


Figure 1. The relationship of the variables in the process of learning physics based on the group model building

From Figure 1, it can be seen that the ability to understand physics can be influenced by the existence of variables that support the understanding of physics. The arrow pointing inwards indicates the variable that is the destination. While the direction of the exit arrow is a factor that supports achieving the goal variable. There are still many obstacles to understanding physics, causing low comprehension skills, including learning that still uses conventional methods (Elisa et al., 2017; Suryana, 2020; Wandini & Sinaga, 2018). In addition, physics lecturers have not been able to train understanding skills so that students cannot study physics (Al-Farisi et al., 2022; Latar & Rummahlewang, 2020). In Figure 1, it can be seen the factors that influence student understanding such as learning media, through a media certainly helps the process of students understanding about a material. The function of learning media has an attention function to stimulate student abilities, affective functions are related to good and attractive visuals, cognitive functions are media that can improve students' cognitive abilities, and compensatory functions mean helping students remember in learning (Casnan et al., 2018).

Problems that affect student understanding in learning physics, it is necessary to have a strategy for solving these problems. The first problem is related to the student's self, namely motivation. Motivation is a person's state, which encourages him to carry out certain activities in achieving the specified goals. The strategy that can be done in overcoming this problem is an increase in a sense of responsibility to oneself, having good interactions between students so that they can discuss with each other overcoming not understanding the material. However, student learning motivation can also be increased through good learning by giving awards given by teachers or lecturers in the learning process (Parwati & Suharta, 2020; Revilla et al., 2022; Shahid, 2015).

The second is the learning pattern, the problem strategy in the learning pattern can be overcome through the methods applied when learning physics must be varied. Most learning patterns tend to make students passive, or only the lecturers provides communication in terms of the lecture method. However, over time, it is necessary to change learning patterns such as playing games before learning begins or implementing learning models that can involve all students (Al-Farisi et al., 2022; Hussin et al., 2019; Roza et al., 2022).

Subsequent problems are often considered normal. But the longer it will result in someone not focusing on learning material. An ignorant friend becomes a problem that is often faced. Other students will feel disturbed by the behavior of their friends, so the strategy that can be done is to take firm action by the rules or regulations that have been provided by each school or educational institution (Mulyati & Guntarsih, 2018; Wandini & Sinaga, 2018).

Next is related to the concentration of students in learning. Usually influenced by environmental factors. The strategy that can be done is to create a comfortable study room, smooth air circulation, away from the noise, adequate layout, and a clean room environment (Al-Farisi et al., 2022; Heong et al., 2020).

Then the next problem is learning media. The media used are usually only two-dimensional. For learning media to function properly in the learning process, it is necessary to have media selection criteria before use. In addition, use learning media that are under the progress of the times, namely technology-based as provided by several online platforms (Abdullahi et al., 2014; Alvarez, 2020; Casnan et al., 2018).

The lecturer's ability that becomes a problem for students in understanding physics learning is the lack of innovation and creativity of lecturers in delivering physics learning. With this lack of ability, what needs to be done is to provide various competency pieces of training for each physics lecturer so that they can teach in a fun way and be able to stimulate students to be interested in learning and understanding physics (Casnan, Triwahyuni, et al., 2022; Elisa et al., 2017).

Then the problem that affects the ability to understand physics is the lack of a practicum process carried out. Students generally tend to be very happy if an explanation is accompanied by a form or description of the thing being discussed. Practicing directly so that students immediately see changes related to physics material. That way, what must be improved is the implementation of scheduled practicums so that learning can be more enjoyable (Al-Farisi et al., 2022; Casnan, Purnawan, et al., 2022; Roza et al., 2022).

Competitions in learning physics are still relatively rare, even though the application of physics is very useful to be applied in everyday life. The strategy to improve understanding of physics requires physics competitions to attract interest and motivation to study physics (Lestari, 2021; Panergayo et al., 2022; Suratni et al., 2021).

The last problem is the quiz. This problem is because there is no appreciation from the lecturer in the learning process, holding physics quizzes regularly and fully prepared can increase interest in learning to understand physics material. In addition, with quizzes, students can remember and review the material that has been delivered (Al-Farisi et al., 2022; Lestari, 2021; Widiastuti et al., 2022). The list of problems and programs to overcome problems in the Physics learning process is shown in Table 1.

Table 1. Strategies of Problem Solving

No	Constraints	Programme
1	Student Motivation	Increase the sense of responsibility yourself. Give awards for student work.
2	Learning Patterns	Change and apply a variety of learning met
3	A Friend of Ignorant	Given the actions of the appropriate discipline.
4	Concentration Learning	Create a comfortable environment
5	Learning Media	Good and according to the criteria of media
6	The Ability of the lecturers	Sharpening competence of lecturers through training or seminar
7	Practicum	Multiply and schedule the activities of the practicum
8	Race	Held a variety of race physics
9	Quiz	Multiply the quiz as an exercise to review the material

Based on Table 1, it can be seen that the problem-solving strategy undertaken to achieve the goal of understanding physics material is through a program that is determined as a solution to the

constraints that affect it. The obstacle that becomes the driving factor for students in understanding physics material is the ability of the lecturer through creativity of a lecturer. If in the learning process a student accepts various learning processes, then the lecturer as a provider of information must be smart and able to innovate so that understanding of physics material can be conveyed properly.

Conclusion

According to research was done using systems thinking, the data demonstrates that student understanding is the objective variable in the learning process. The supporting variable to better grasp the lecture material is the lecturer's skill through the lecturer's creativity.

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