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Common Problems in Learning Simple Electrical Circuits at Elementary School and Their Solutions

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Abstract
Learning about simple electrical circuits is a crucial part of Science (IPA) education in elementary schools. However, its implementation often faces various obstacles. This study aims to identify the common problems in learning simple electrical circuits and to formulate effective solutions. Using a descriptive qualitative method with data collection through literature studies and interviews with sixth-grade teachers at SDN 1 Sidodadi, this research found three main issues: 1) Educators' lack of understanding and skills in teaching the concept of electrical circuits, 2) Students' low learning motivation and enthusiasm, often caused by the overuse of lecture methods, and 3) Lack or unavailability of tools and materials for practical activities. The solutions proposed to address these problems include: teachers participating in training to improve their professional competence, applying innovative learning models such as Project-Based Learning (PJBL) and experimental methods to increase student activity and motivation, and utilising appropriate learning media, ranging from realia (physical teaching aids) to PhET simulation media as a substitute when physical tools are unavailable. The conclusion of this study emphasises the importance of the teacher's role in continuously striving to improve the quality of learning through these various solutions, thereby achieving learning objectives effectively.

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INTRODUCTION

Natural Sciences (IPA) is an essential subject at the elementary level to equip students with organized knowledge about nature through exploration and analysis (Sakila et al., 2023). One of the crucial topics in science is simple electrical circuits, which are the foundation for understanding the concept of electronics and the application of everyday technology. However, physics material is often considered abstract and complex for learners to understand, mainly due to the lack of direct practical involvement (Beniarti et al., 2018; Rohman & Lusiyana, 2017). This demands an

innovative learning approach to improve conceptual understanding.

Learning difficulties are experienced not only by students but also by educators. Teachers often face obstacles such as a limited understanding of electrical concepts, lack of access to adequate learning media, and concerns about the risks of electrical practicums (Ardianto & Rubini, 2016; Rohman et al., 2024). The lack of training and resources means that teachers tend to teach theoretically, reducing the attractiveness and effectiveness of learning.

These limitations have a significant impact on students' low learning outcomes. Studies show that science learning without practicals or teaching aids reduces students' ability to apply real-world concepts (Saputra & Mustika, 2022). As a result, students find it challenging to build a holistic understanding of electrical phenomena, including the difference between series and parallel circuits.

To overcome this problem, a systematic solution is needed, such as developing interactive learning media, teacher training, and integrating safe experimental methods. Previous research confirms that simple digital simulators or laboratory kits can reduce risk while increasing student engagement (Rohman & Lusiyana, 2017).

Based on this description, this study aims to analyze the challenges in learning simple electrical circuits and formulate evidence-based solutions for educators. These recommendations can improve the quality of science learning and encourage science-technology literacy from an early age.

METHOD

This study uses a descriptive qualitative approach to analyze problems and solutions in learning simple electrical circuits. According to Rusandi and Muhammad Rusli (2021), descriptive research aims to describe phenomena through in-depth data collection from sources, then presenting it as a systematic narrative. The focus of this study is to understand the challenges educators face and explore effective learning strategies based on teachers perspectives and literature studies.

Data collection was carried out through literature studies and semi-structured

interviews. The literature study involved an analysis of reliable sources such as books, scientific journals, and articles related to the concept of electrical circuits, learning difficulties, and educational media innovation. In addition, interviews were conducted on 23 September 2024 with three grade VI teachers from SDN 1 Sidodadi, East Lampung, to obtain contextual data about implementing the material in the field. The sample was selected purposively, with the criterion of teachers with at least five years of experience in teaching science.

Data were analyzed through data reduction, findings presentation, and conclusions verification (Miles et al., 2014). The interview results were transcribed and categorized based on pedagogical constraints, media availability, and training needs. Source triangulation was done by comparing interview results and literature to validate the findings. This research adheres to the principles of academic ethics, including informed consent and respondent anonymity.

RESULTS AND DISCUSSION

Electrical material is one of the basic materials in Physics. Its applications cover many aspects of everyday life. The concepts of physics in the field of electricity are primarily invisible and difficult to learn and study in a real way. Many students, prospective teachers, and physics teachers struggle to understand electrical concepts, especially in electrical circuits. Students, prospective educators, and physics educators' difficulty understanding an idea can lead to misconceptions (Hesti et al., 2018).

According to Jannah, the low learning outcomes of students cannot be separated from the lack of variation in the learning process. Most of the learning methods and atmospheres in schools used by our teachers hinder rather than motivate children's potential. Mistakes in using learning methods will hamper students' motivation (Haryati, 2022). The inhibition of students' motivation to learn will cause students to become passive when learning and will reduce students' learning outcomes.

In addition, one of the factors that cause low student learning outcomes in learning

simple electrical circuits is the educators' skill. One of the reasons why educators find it challenging to assemble parallel electrical circuits is that they are not accustomed to using learning props in every teaching and learning activity. They tend to use more lecture and question-and-answer models to carry out classroom teaching and learning activities (Wahyudi et al., 2023).

Based on interviews with several educators of the sixth-grade teacher at SDN I Sidodadi, several problems that are often experienced in carrying out learning activities in simple electrical circuits are as follows;

According to Mr. Gunanto, educator of sixth-grade teacher A, the problem that often occurs is the lack of teaching aids as learning media, even though some of the tools have been around for a long time and can no longer be used, so he has to tell the children to bring their tools for practice, learners have difficulty in doing the practice, especially in using the practice tools, learners sometimes do not pay attention and play around on their own, learners have different levels of understanding, there is not enough time, and only the smart ones work when it is time for practice.

According to Mrs Ayu Sofiyani, the class teacher of VI B, the problems that occur are that educators still have difficulty in distinguishing battery poles and distinguishing circuit shapes, so when they practice, educators find it challenging to distinguish them, the results of student practice often show that the lights do not come on or fail. Educators find it challenging to find the cause; there are no available tools, so they have to order students to bring them themselves, students have difficulty assembling electrical circuits, and there is not enough time to complete learning and practical activities.

From some of the statements above, it can be concluded that the problems that often occur in learning simple electrical circuits in elementary schools are the difficulty in understanding the simple electrical circuit itself, the lack of motivation to learn due to the lecture method that is often used so that students feel bored, inadequate facilities and infrastructure, and lack of learning time.

Discussion

Based on problems that often occur in learning activities on simple electrical circuits, several solutions can be provided, starting from the mastery of skills and an educator's understanding of simple electrical circuits. Educators can participate in training activities or ask more senior and expert educators to teach them simple electrical circuits. With this training activity, educators can improve the knowledge and skills they want to master in learning activities (Akbar, 2021).

After the educator, the following solution is the learning model and method used. One learning model that can be used is the Project Based Learning (PJBL) model. The Project Learning model is a learning model that requires students to be active and construct their abilities to complete projects given by educators with their peers in groups (Taupik & Fitria, 2021). With this model, students can be more motivated and understand learning activities because students actively carry out practical activities together. This is supported by research conducted by Hanif, which states that using the Project Learning model makes students more motivated and creative and prevents them from getting bored quickly during learning (Hanif, 2018).

Most educators in learning activities always use the lecture method. This makes students feel bored and unmotivated, so other methods are needed in learning activities for simple electrical circuits, such as the experimental method. The experimental method is a method in which learning activities are carried out by conducting experiments on something, observing the process, writing down the results, and presenting them in front of the class to be evaluated by the educator. By using the experimental method in learning activities on simple electrical circuits, students actively carry out experiments, listen and pay attention to the educator, and discuss with each other so that it will have a positive impact on students' learning achievements (Solikati, 2021)

Another critical factor in the success of learning activities is learning media, especially in learning activities on simple electrical circuits that require direct activities (practice). The most suitable media is realia, which can carry out

practical activities, especially in learning simple electrical circuits. According to (Dinalis S., 2017), realia is a medium that exemplifies media in a tangible way to make learning activities easier (Susilowati et al., 2021). Real media, such as physical equipment or concrete models of the concepts taught, can help students visualize abstract ideas and improve understanding. Every school usually has simple electrical circuit tools or teaching aids, but most are old and broken. Therefore, educators can replace them with disassembled flashlights or buy the equipment in an electronics store and assemble it themselves.

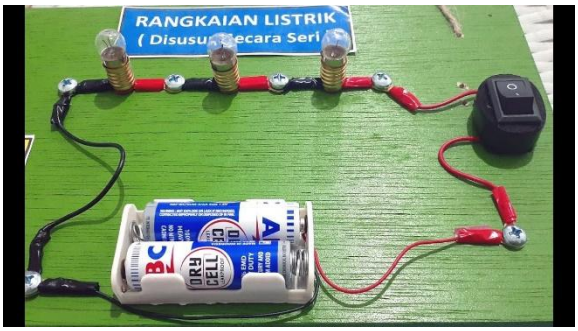

Figure 1. Image of realia media

Another medium that can be used to learn simple electrical circuits is the PhET simulation medium. PhET is an online simulation medium operated by a smartphone, laptop, or computer. PhET simulation is an interactive learning medium that allows learners to carry out independent simulation activities and provides opportunities to understand and learn concepts at any time and repeatedly (Nisa et al., 2024). With PhET media, educators do not need to bring equipment to carry out practical activities; they need a smartphone or laptop and data network to access it. According to research by Narulita et al. (2024), learning activities using the PhET application can increase student motivation. This is because the medium allows students to learn while playing. Schools that do not yet have fundamental tools or materials for learning simple electrical circuits can use this medium and only need a smartphone or laptop and a data network (Narulita et al., 2024).

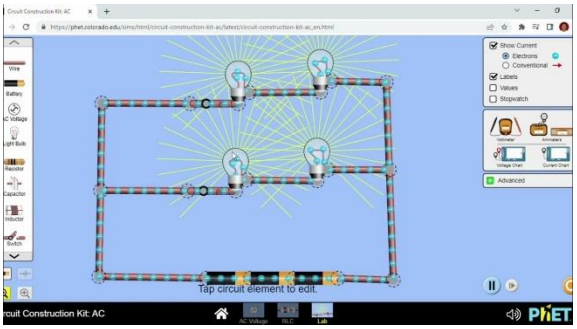

Figure 2. PhET simulation media image

CONCLUSION

In learning activities involving simple electrical circuits, there are many problems in their implementation, ranging from

educational factors to school facilities. Issues often found include educators' lack of understanding and skills, a lack of enthusiasm and motivation to learn among students, and a lack of or absence of tools and materials for conducting learning activities involving simple electrical circuits. Therefore, educators must try their best to solve existing problems so that learning activities can run properly and effectively. Some solutions that researchers can provide are participating in teacher training, choosing suitable and effective learning models and methods such as the PJBL model and the experimental method, using realia media or teaching aids, or, if not available, using PhET simulation media.

LIMITATION OF THE RESEARCH

Based on the results of this study, various aspects can still be explored further to improve the effectiveness of learning simple electrical circuit materials in elementary school. One aspect that can be researched is the development of technology-based learning media, such as interactive simulations, augmented reality (AR), or educational applications. This study can evaluate how technology can improve students' understanding and involvement in learning simple electrical circuits. In addition, exploring more effective learning methods can also be the focus of further research, for example, by comparing the effectiveness of project-based learning, problem-based learning, and the STEM (Science, Technology, Engineering, and Mathematics) approach.

Subsequent research can also focus on analyzing students' conceptual difficulties in understanding simple electrical circuit material. Understanding the most difficult parts of the material makes it possible to develop more appropriate learning strategies. In addition, the involvement of parents in science learning at home can also be the subject of further research to understand its effect on students' understanding and interest in electrical material. Another research that can be done is to evaluate the effectiveness of teacher training in improving the quality of learning. This study can examine the teaching strategies applied before and after training and their impact on student learning outcomes.

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