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## Research Article

### Alternative Teaching Methods in Electricity and Magnetism: A Literature Review

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#### ABSTRACT

Electricity and magnetism are known as an important topic in the physics and scientific curriculum at all levels, including elementary, secondary, and tertiary. Children can learn more about electricity and magnetism via discussion and activities. Electricity and magnetism also have applications in many aspects of our daily life as one of the fundamental areas and key concerns in physics. Traditional teaching methods are considered ineffective. Pupils who were taught using traditional methods or approaches, according to Jelicic et al. (2017), have a poor comprehension of basic electromagnetic principles and are often resistant to teachers' instruction and our education now is dependent on technology. In this review, the different alternative teaching methods used and preferred by other schools are being examined and its effect in teaching Electricity and Magnetism. The included studies in this literature review proved that the preferred teaching method to motivate and appreciate the importance of learning Electricity and Magnetism. Hence, students learn more thorough understanding concepts and the performance of things through active participation.

**Keywords:** *Alternative Teaching Methods, Electricity and Magnetism, Experiential Learning, Systematic Review*

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#### Introduction

Electricity and magnetism are known as important topics in the physics and scientific curriculum at all levels, including elementary, secondary, and tertiary. Children can learn more about electricity and magnetism via discussion and activities. Electricity and magnetism also have applications in many aspects of our daily

life as one of the fundamental areas and key concerns in physics. This sector, on the other hand, has many conceptions in which students create opinions that are not scientifically accepted. Because electricity and magnetism are abstract and sophisticated concepts, they are especially difficult for students to grasp.

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According to Bagno and Eylon (2022) several researchers have reported students' difficulties with electricity and magnetism. Learners have difficulty mastering the fundamental ideas in the concepts, comprehending the concepts, and judging the link between the central ideas of the concepts to solve issues. Furthermore, quantitative problem-solving success is not a reliable indicator of conceptual understanding. According to research, even if pupils excel at addressing quantitative problems, they struggle with conceptual ones. Some students achieve great grades despite a lack of grasp of some fundamental physics principles. It has also been noted that when asked solve problems in many poor countries, a large majority of students lack the requisite conceptual understanding. (Mboniyirivuze, 2019).

It is possible that one of the causes for this disparity is the way typical physics classes are taught. This issue arises because the physics teaching technique does not correspond to the content. Physics and students' learning styles In Nigeria, the majority of physics teachers lecture pupils verbally rather than using instructional aids to aid their understanding. As a result, a large number of pupils are unable to complete their assignments. Those who studied physics concepts and principles through this traditional teaching style rely on the notes of their teachers as their primary source of information, and they endeavor to read, memorize, and apply what they have learned without completely comprehending the fundamental notion, physical rules and terminology.

The topic matter in a traditional class is almost typically delivered in a lecture in front of a class. In a traditional class, the subject matter is nearly always delivered in monologue fashion in front of a passive audience. It is not easy to provide adequate opportunities for students to critically think in the course of developed arguments. There is a slew of additional elements that can affect how well learners succeed in physical sciences. Learners' learning preferences and teachers' teaching methods are two examples of such aspects. Traditional teaching strategies which are usually teacher-centered have been claimed to be ineffective in developing students' conceptual understanding.

Some studies reported that noticeable conceptual understanding change in learners after being taught using traditional teaching methods was short-lived (Mboniyirivuze, 2019). A main concern for educational researchers and educators has been finding ways to improve current learning techniques to consequently improve students' conceptual understanding. Using different educational strategies that could focus not only on the conceptual theory taught to learners, but also on the difficulties high school and university students encounter when learning abstract concepts has been recommended by various authors.

Current teaching methods are commonly known for their use of visual support, but despite current techniques, there is still a less explored teaching area that uses force feedback technology as an aid to visual educational materials. Modern learning theories, such as the theory of embodied cognition, suggest that learners use their perceptual and psychomotor systems to learn, besides their conceptual system (Adams, 2010). Therefore, different instructional strategies have been used to improve students' conceptual understanding of electricity and magnetism.

Alternative teaching methods is a general term for many teaching methods that are intended to replace the traditional frontal teaching method in which a teacher stands at the front of a classroom and transmits material (Nurutdinova, et al 2016). The main alternative teaching methods that are repeatedly described in many studies, particularly in the context of adapting teaching methods to the 21st century, are project-based learning, exploratory learning, collaborative learning, and integration of technologies in teaching.

### **Statement of the Problem**

The main goal of this literature review is to provide an extensive review of the alternative teaching methods in electricity and magnetism subjects in a 21st century setting.

Specifically, this research aims to answer the following:

1. What are the common alternative teaching methods in teaching and learning electricity and magnetism?

2. Which of the strategies is preferred by the teachers and students?

**Methods**

This chapter discusses the research design, Samples, Data gathering procedure, Data analysis, Discussion, Study Selection, Study Eligibility, Ethical reconsideration, and Results.

**Research Design**

The researchers followed PRISMA's guiding concept when performing this study review. The PRISMA principles focus on how researchers may guarantee that their literature reviews are transparent and thorough. The PRISMA principle helped researchers create a flow in their data gathering process by identifying, screening, and establishing inclusion criteria.

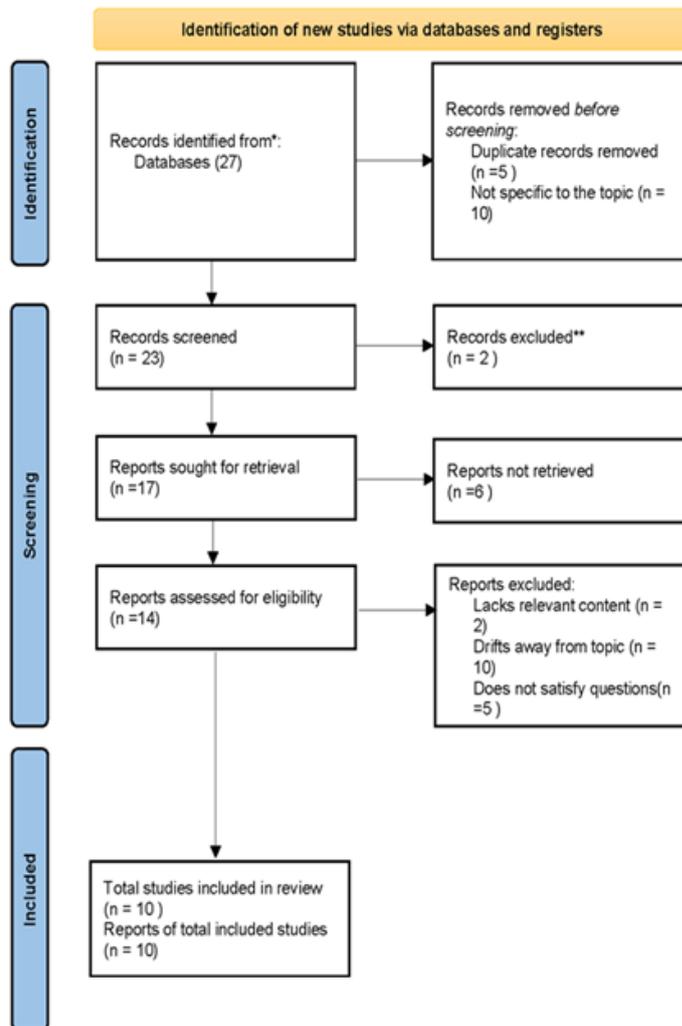


Figure 1. Research Design Flow chart

**Samples**

For the research sample, the researchers only include data publication from 2005 to 2022. All the related studies screened further for data analysis and the researchers used the six generic steps that are involved in conducting a literature review as explained in Templier

and Paré (2015). The six generic steps are (1) formulating the research question(s) and objective(s), (2) searching the extant literature, (3) screening for inclusion, (4) assessing the quality of primary studies, (5) extracting data, and (6) analyzing data.

Table 1. List of Inclusion and Exclusion Criteria guidelines in selecting relevant studies from online source

Inclusion	Exclusion
Articles, Journals, Researches about Strategies in Learning	Payable or need to subscribe articles
Complete document including result/findings and conclusions	Studies from 2005-2022

### **Sampling Technique**

Researchers collected a set of data or samples from the certain mentioned sources (Google Scholar and Springer), and PRISMA will be utilized to conduct this literature review.

### **Data gathering Procedure**

The study was conducted through online research. The researchers collected different published articles in an online database such as Google Scholar, Web of Science, and ResearchGate about the different alternative teaching methods in Electricity and Magnetism subject. The researcher used different terms to look for publications in looking for articles and journals. The following words or phrases were being used: Alternative teaching method, Electricity and Magnetism, Alternative teaching methods in Electricity and Magnetism, Teaching Methods in Electricity and Magnetism.

From 2005 to 2021, these search terms should appear in the title, abstract keywords, or abstract of the publication. The researchers then proceed to choose the relevant publishing articles for inclusion in the review by searching for the title and abstract of each record. After initial screening 14 studies were found to be relevant and valid publications and the 13 studies were removed. After the thorough screening, 10 publication articles remained to be included in the review.

### **Data Analysis**

The researchers used various data set analysis steps to assess the data, beginning with a search of related literature in internet databases. The researchers then proceeded to pick relevant published publications for inclusion in the review by searching for the title and abstract of each record. Furthermore, the

researchers evaluate and sort out all of the articles and journals.

### **Results and Discussion**

#### ***Alternative Teaching Methods in Electricity and Magnetism***

During this whole duration of searching and reading journals and articles about alternative teaching methods on electricity and magnetism, all the journals that were analyzed, studied, and criticized by the researchers focus on different alternative teaching methods for electricity and magnetism were the results of the journal's aim to introduce alternative teaching methods to the readers, especially to the teachers in electricity and magnetism courses for easy deliveries of knowledge from the teacher and learning process for the student.

It also emphasizes the articles on how traditional methods of the teacher became the reason for student difficulties in understanding science specifically in electricity and magnetism that gives complex ideas and context, It shows in the result of the study on how alternative methods of teaching electricity and magnetism can be a great help to deliver learning to the science-related student.

#### ***Jigsaw Teaching Method***

In the study of Karacop (2017) about Jigsaw methods, the result shows that using this method in teaching electricity and magnetism is more effective in the teaching process than the traditional teaching methods wherein the review of the studies identifies that jigsaw methods provide higher performance in both experimental and theoretical aspect it increased student achievement and active class participation. In addition, letting the student gather information and give an explanation to

each area to contribute to the learning process of the student.

This method emphasized that sharing a certain knowledge and information in the group of learners would help the student to cooperate with others for building knowledge. However, this method would be hard for those students who have no background in hands-on experiments (Zacharia et al., 2010). Jigsaw teaching method shows that the student experiment has the supervision of the expert which makes it more effective and is more effective than a common or traditional laboratory since this method focuses on student-centered ideas.

#### *Virtual Laboratory and Simulations*

In the study of lab simulations by Ilie et al. in 2021, the result shows that virtual-real laboratories help in understanding the conceptual concept of electricity and magnetism, and help the student to follow the goals and discussion in a certain science topic. This method will measure the capacity of a student on formative and summative assessment capability the virtual-real lab can help the student to visualize the mechanism, forms, and movement of the experiment, creates more constructing and enlightenment to the objective function to assist the knowledge.

Simulations and virtual labs are the replacement of traditional laboratory practices; it shows in the studies that it is more effective than the usual lab methods. To identify its effectiveness the researcher used manipulated a question that will study student knowledge gained from the usual lab activities in the virtual labs.

#### *Interaction-intervention Method*

In the method of interactive -intervention strategy (Ukoh, 2022), the result shows that is more effective compared to the usual traditional discussion on discussing principles and concepts of electricity and magnetism. Ogunbowale et al. (2014) studies agree with the result of an interactive -intervention as an effective method used for teaching science, the study's result shows that this method opens an opportunity to the student for more engagement and hands-on activities for assisting the knowledge gains in electromagnetism.

This method makes the concept of electricity and magnetism easier to understand as it makes a student create or visualize every topic and find the interaction from one concept to another one. This method exposed students to be more active and make their observations in certain experiments, also discussing thoroughly and letting the student do a worksheet, lab reports, or oral recitation to mold students' retention that will be used in the next experiment.

#### **Conclusion**

The purpose of this review was to view the alternative teaching methods in teaching Electricity and Magnetism subject within the past seventeen years and see how it is being applied in education and its effect on students acquiring knowledge and skills that can be a lifelong learning and is still changing. It focusses on providing activities that will allow students to think critically, explore, enjoy, and at the same time learn Electricity and Magnetism concepts with the support of other alternative teaching methods in order to achieve the quality education needed

It is clear from the research reviewed those Virtual laboratories are very effective and efficient in teaching and learning methods as seen in Putri et al.'s study and it can achieve expertise in studying scientific phenomena (Ipalakova's study). It is widely practiced in universities and other private higher institutions. On the other hand, it is also reviewed that the alternative teaching method that can be used to solve the problems in understanding the concept of electricity and magnetism is the interactive-intervention where students can engage and participate with hands-on, eyes-on and mind-on activities that gives learners an opportunity to have concrete and real-life learning processes in electricity and magnetism. Ukoh et. al.'s study and to achieve expertise in studying scientific phenomena Ipalakova's study.

MLMs improve learning outcomes by concentrating on multimedia concepts and how people learn from words and pictures in computer-based environments and force students to focus on the core ideas by removing extraneous language or objects according to Sadaghiani's study.

This field of inquiry is very important as at its center is a concern with helping students become better and improve their knowledge and skills in electricity and magnetism.

Helping students become better in learning electricity and magnetism concepts, problem solvings, and real world scenarios such as through experiments and getting students to see the importance in growing as independent students is also extremely important in our current society. The alternative teaching methods mentioned in this literature review are effective in the teaching and learning process of Electricity and Magnetism subjects and courses. These are also preferred methods by teachers and students in studies as utilized in universities and school's traditional classroom and online setting.

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