

## **The Use of Miniature of Electric Power Line System In Electricity Distribution Network Subject At SMK Negeri 2 Banda Aceh**

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### **Abstract**

*Students need to learn about power distribution networks in order to comprehend how electricity is distributed from its source to its consumers. However, many students lack interest and have trouble understanding the theory of distribution systems. The goal of this study is to develop a tiny teaching tool that will be used in Class XI of the Electrical Network Engineering Department at SMK Negeri 2 Banda Aceh to teach the concept of power distribution networks. The objective is to validate and assess the merits of employing small media while instructing students about power distribution systems. Data are gathered using an experimental methodology in this study and through validation, observation, documentation, and testing. The study's findings suggest that making small media for power distribution systems is appropriate for teaching. When compared to the pre-test score of 61.65, the final test results demonstrate a remarkable improvement, with an average post-test score of 90.00. Therefore, SMK Negeri 2 Banda Aceh's use of teaching materials utilizing tiny power distribution systems is very effective in improving students' learning outcomes in the subject of power distribution systems.*

**Keywords:** *Miniature Use, Electric Power Distribution Network, Learning outcomes*

### **Abstrak**

Pelajaran jaringan distribusi tenaga listrik penting bagi peserta didik agar memahami sistem distribusi listrik dari sumber hingga ke konsumen. Namun, siswa sering kurang aktif dan kesulitan memahami teori sistem distribusi. Penelitian ini memfokuskan pada pembuatan media ajar miniatur dan menerapkannya di mata pelajaran sistem distribusi tenaga listrik pada Jurusan Teknik Jaringan Tenaga Listrik Kelas XI SMK Negeri 2 Banda Aceh. Tujuannya adalah memvalidasi, serta mengevaluasi tingkat efektifitas dalam penggunaan media miniatur dalam materi ajar mata pelajaran sistem distribusi tenaga listrik. Metode penelitian ini menggunakan pendekatan eksperimen dan pengumpulan data melalui validasi, observasi, dokumentasi, dan tes. Hasil penelitian menunjukkan bahwa pembuatan media miniatur sistem saluran tenaga listrik layak digunakan dalam pembelajaran. Hasil tes akhir menunjukkan peningkatan yang signifikan, dengan nilai rata-rata post-test 90,00 dibandingkan dengan pre-test 61,65. Dengan demikian, penerapan media ajar menggunakan miniatur sistem saluran tenaga listrik sangat efektif untuk meningkatkan hasil belajar siswa di mata pelajaran sistem distribusi tenaga listrik pada jurusan teknik jaringan tenaga listrik kelas XI, SMK Negeri 2 Banda Aceh.

**Kata kunci:** *Penggunaan Miniatur, Jaringan Disribusi Tenaga Listrik, Hasil Belajar*

### **Introduction**

Achieving learning objectives depends in large part on the teaching and learning process. The success of the process is influenced by a number of variables, including educators, students, the environment, techniques, and learning resources. The

effectiveness of learning can be improved by using the right learning resources [1]. The use of media that is appropriate for the subject matter and the students' age has a significant impact on students' comprehension and acceptance of new ideas. Therefore, establishing an effective learning environment depends on selecting the appropriate media and teaching techniques. As the name suggests, miniature learning media refers to the use of electronic resources as teaching aids. Due to smartphones, tablets, and other electronic devices, these ideas have gained popularity in recent years. Comparing this technique of learning to more traditional ones, it is more affordable and convenient [2]. Students with time and/or space constraints are just one type of student who can benefit from miniature learning materials. With the conventional approach, students must physically attend a class in order to access the materials; however, with micro learning media, they can access the information from any location at any time. This is especially helpful for commuters who can read or watch brief educational videos on their cellphones or tablets while traveling to work or school [3]. In addition, since small learning resources are portable, students can tailor their learning experiences and proceed at their own speed.

Access to information on learning activities with a broad scope and compact size is another benefit of micro learning media, which makes it quicker to achieve learning objectives. Thumbnails offer a platform for interactive learning, evaluation, and feedback, making them a desirable addition to course material. Due to their usefulness, affordability, comfort, personalization, and simplicity of access to data and resources, miniature learning media have become popular as an innovative method of learning [4]. Distraction, lack of concentration, and potential effects on the traditional classroom environment are issues that need to be addressed. Despite these reservations, mini-learning media continue to be a valuable tool that teachers and students can utilize to supplement conventional teaching strategies and accomplish their educational objectives.

According to research conducted by [5], using small electrical installations in the subject of electric lighting installation can improve student learning outcomes and excitement for learning. The usage of the SITAYA miniature media "Solar System" through the Treasure Hunt technique has an impact on the science learning outcomes of fifth grade pupils, according to research by [4] at SDN Bawakaraeng II Makassar. It was discovered that the usage of miniatures helps students understand the information the instructor is presenting, and that using miniature media improves student learning results. According to the findings of earlier studies, micro learning media have shown to be appealing as a cutting-edge learning strategy. The benefits of using this media include its usefulness, affordability, convenience, personalisation, and ease of access to information and services. However, there is a dearth of learning resources, such as teaching aids in the form of miniature power line systems, for class XI students majoring in electrical power network engineering at SMK Negeri 2 Banda Aceh who are studying the electric power distribution network. Therefore, it is crucial to offer these small media to students in order to facilitate immediate understanding and improve the efficacy of the educational process.

## Literature Review

Mini-visual aids, which offer interactive and visual tools to boost learning and engagement, can be used to improve educational media. In other words, a miniature is a three-dimensional duplicate of an object. According to [6], a miniature can even perform a function that is identical to that of the big object. Through the use of scaled-down reproductions that are functionally and aesthetically similar to the original objects, instructors can communicate with pupils about important concepts and facilitate communication in the classroom. The usage of miniature media in the learning process

makes the subject matter more engaging to view, and students become enthusiastic and engaged, which improves their grasp of the subject matter [4]. A tiny electric power distribution system plays a crucial function in helping teachers explain how the system works in the classroom. An electric power plant, a transmission network, and a distribution network make up the system's three primary parts. The power plant's job is to use a variety of techniques to transform primary energy sources into electrical energy. A step-up transformer is then used to direct electrical power through the transmission network until it reaches the load center or substation. Electricity is distributed from the substation through the distribution network to the distribution transformers, where it is subsequently received by consumers.

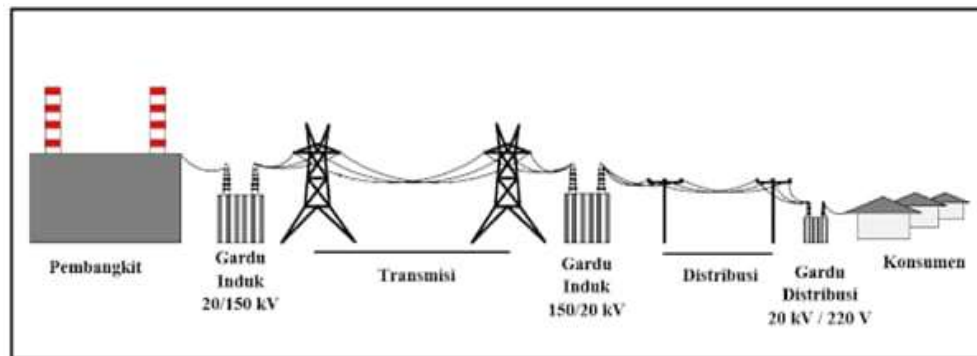


Figure 1 Electrical Power Line System

The power distribution channel system must be designed in such a way that the distribution of electric power can reach customers with good power quantity and quality, for a clearer picture of the electricity distribution system can be found in Figure 1.

## Methodology

The research that uses the experimental technique and a quantitative approach. By changing the independent variables and seeing how they affect the dependent variable, the experimental technique is used to assess the validity of the hypothesis. The research subjects in this study were XI Electrical Power Network Engineering (TJTL) students who were studying electric power distribution networks. Pre-learning and post-learning are the two phases that make up the learning process. Students don't employ small learning materials throughout the pre-learning phase of the learning process, but they do during the post-learning phase. This study's major goal is to monitor and examine how using a small power distribution system affects students' learning outcomes.

The flowchart affixed to Figure 2 shows a more thorough research procedure. An overview of the procedures used in this investigation, from sample selection to treatment, measurement, and data analysis, is given in this flowchart. This study intends to get a deeper knowledge of the impact of employing small media in learning electric power distribution networks through the use of experimental methodologies and a quantitative methodology. The tests (pre-test and post-test) and expert validation used in this study are the instruments. It attempts to assess the accuracy of the miniatures and, through their use, improve pupils' comprehension. The test has 20 multiple-choice questions, 5 true/false questions, and 5 essay questions. The validation questionnaire has 15 questions.

The validation values provided by experts were assessed in a descriptive manner using percentages in order to assess the viability of miniatures and training materials. The total value of all the responses is divided by the maximum total value established to determine the percentage of eligibility.

Using the Kolmogorov-Smirnov method, the sample data normality test was conducted in this study [7]. This method is only used to single data or single frequency data; group frequency data are not utilised. The following hypothesis is being tested in this test, with the significance value set at 0.05:

H<sub>0</sub> : Data is not normally distributed

H<sub>1</sub> : Normal distributed data

In this test, there are criteria to determine whether H<sub>0</sub> is rejected or accepted. H<sub>0</sub> is rejected if the probability value of significance ( $p$ ) is greater than 0.05, H<sub>0</sub> acceptable if the probability value of significance ( $p$ ) is less than 0.05. In addition, the study also involves a students' learning outcome evaluation using a certain value provision.

## **Result and Discussion**

### **a. Validation**

The validation of the miniature media of the electricity channel has been carried out by the head of the electrical laboratory at the State SMK 2 Banda Aceh namely Ms. Maryana, S.T., through a direct meeting on September 19, 2022. The purpose of this validation is to evaluate the viability of miniature power channel media before it is used in the teaching learning process. The results of the validation showed that the miniature power channel media obtained a total score of 75 out of a maximum of 75, with a 100% eligibility presentation. It shows that the miniature media of the power channel has met the criteria set in the validation process, both in terms of quality, accuracy, and usability. Thus, the value given by the media expert to the miniature media of the power channel is expressed in a qualifying category to be used in the learning process.

The teacher that teaches the topic of electrical energy distribution systems, Mr. Aditya Dharma, S.Pd., M. Pd., is in charge of validating the information included in the miniature medium of the electrical power distribution system. On September 19, 2022, a face-to-face meeting with him served as further validation. The accuracy, applicability, and dependability of the information supplied in the document are examined during this validation procedure. To ensure that the intended audience, namely students in class XI TJTL, can comprehend and apply the information correctly and avoid errors and misunderstandings when learning about the power distribution system, material validation is crucial. The material's micro power channel, which underwent a comprehensive validation procedure, was also assessed and is shown in Figure 2 as one of the visualizations that aid students in grasping the topic being taught.

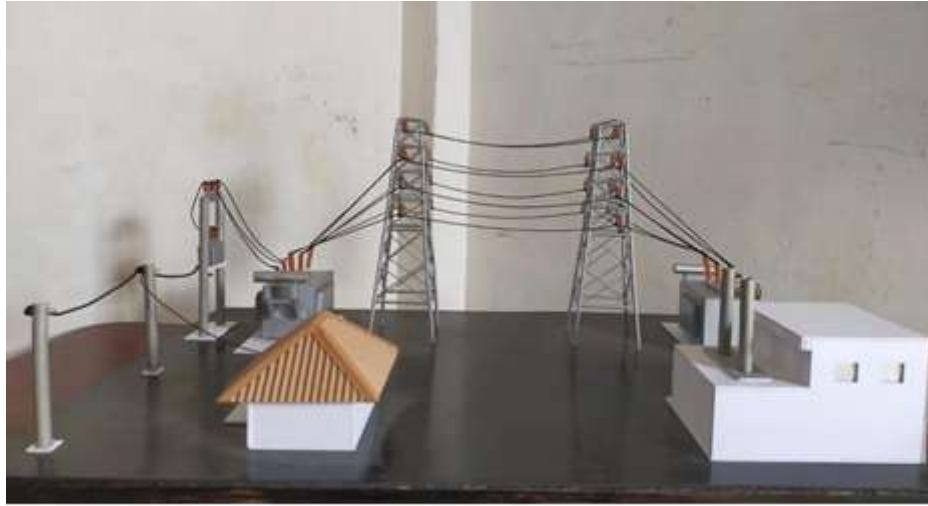


Figure 2. Miniature Shape of Validated Power Channel System

The validation approach carried out by Mother Maryana and Mr. Aditya Dharma, namely media and material validation, succeeded in gaining excellent assessment through a series of validation processes carried out by the tester without the presence of revision. The power channel's miniature media has passed in the evaluation of the effectiveness and quality of its use, as shown by the media validation, the highest total score value, and the validation presentation that achieved 100%. Additionally, validation of the material through assurance of its accuracy, applicability, and dependability demonstrates that the power distribution system's educational content satisfies the necessary criteria. Thus, it can be concluded from the validation results that the materials for the electricity distribution system and the tiny media of electricity channels are declared appropriate and effective for use in the teaching process of students in State SMK 2 Banda Aceh's XI grade TJTL.

#### **b. Study Result**

In order to make analysis and evaluation of the level of student learning intensity easier, the study's learning outcomes from the students are gathered and displayed as tables. The final test (post-test) used to assess students' learning outcomes demonstrates satisfactory performance in comparison to the pre-test score. Data from student test results that illustrate the distinction between the pre-test and post-test are presented in Table 1. This table gives a summary of how well students were able to learn and comprehend "electric power channel" subject after using tiny learning medium.

Table 1. Students' Result Data

No	Nama Siswa	Nilai pre-test	Nilai Post-Test
1	Zaki	53	80
2	Maulida	80	83
3	Abdul	43	83
4	Yusrizal	60	60
5	Israruddin	70	87
6	Qadarillah	36	83
7	Ramadhan	73	93
8	Dion	70	93
9	Daffa	70	100
10	Ilham	80	100
11	Zeskia	67	93
12	Ryan	60	93
13	Dimar	53	87
14	Reza	63	87
15	Hidayat	40	100
16	Rafi	77	94
17	Ravi	77	100
18	Robiarrazi	73	94
19	Roby	70	100
20	Anzar	60	100
21	Mustaqim	33	80
22	Ikram	40	80
23	Rizky	70	100
	Total	1418	2070
	Rata-rata	61,65	90,00

The average value of the post-test (90,00) is greater than the average of the pre-test, as can be seen from the data presented in Table 1. (61,65). This implies that using this small-scale learning tool can increase the effectiveness of student learning results that are higher when learning about the "electric power channel" content. The usage of small media appears to benefit student comprehension and learning achievement in the subject, as evidenced by the large difference in average values. The quality of learning and student learning outcomes in the area of "electric power channels" have thus been successfully improved by the use of micro media as an innovative learning aid.

### c. Normality

A statistical technique known as the normality test is performed to determine whether or not the data we have has a normal distribution. Having data that fits the normal distribution is crucial for statistical analysis because many statistical techniques rely on this presumption. The results of a statistical study may be incorrect or untrustworthy if the data are not regularly distributed. As a result, normality tests are frequently carried out as a first step before advanced statistical analysis. Additionally, the normalcy test aids in the detection of outliers in the data. Perceptions are data that differ greatly from other data and can have an impact on analysis outcomes. We can respond appropriately, such as removing or treating the material specially, by recognizing a search.

		Unstandardized Residual
<b>N</b>		23
<b>Normal Parameters<sup>a,b</sup></b>	<b>Mean</b>	,0000000
	<b>Std. Deviation</b>	8,93174413
<b>Most Extreme Differences</b>	<b>Absolute</b>	,162
	<b>Positive</b>	,110
	<b>Negative</b>	-,162
<b>Test Statistic</b>		,162
<b>Asymp. Sig. (2-tailed)</b>		,122 <sup>c</sup>

Figure 3. Normality Test Kolmogorov-Smirnov

The Kolmogorov-Smirnov normality test was conducted to test whether the data was in a normal distribution. The tests were performed using the SPSS application, which is one of the most commonly used statistical software in data analysis. After conducting the Kolmogorov-Smirnov normality test, the result was that the significance value was 0.122, which is greater than the established significance level. (0,05). It suggests that the data used in this study has a normal distribution. Therefore, we can proceed by performing a paired sample t-test test to compare pre-test and post-test values, with the appropriate assumptions being met. By conducting a normality test in advance, this study can ensure that the statistical analysis is based on the correct assumptions. Thus, the results of the paired sample t-test to be performed can be interpreted more validly and reliably to obtain accurate conclusions about the difference between pre-test and post-test values.

	Paired Differences					t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre-test– Post-t est	-28,348	13,730	2,863	-34,285	-22,411	-9,902	22	,000

Figure 4 Paired Sample t-Test

Based on the data listed in the table, a statistical test is carried out using significance values. (p). The result shows that the significance value (p) is 0,000, which is smaller than the specified significance level (0,005). Thus, the zero hypothesis (H0) that states that there is no significant difference between the pre-test and post-test learning results is rejected, while the alternative hypotheses (Ha) that state that there are significant differences are accepted.

Based on these results, it can be concluded that the use of miniature media of electricity channels has a significant influence in improving the learning outcomes of students on electrical power distribution system lessons in SMKN 2 Banda Aceh, especially for students of XI grade TJTL. Students' learning results on the post-test showed a significant improvement compared to the pre-test, which showed that miniature

power channel media was effective in helping students understand and master the learning material. This result has important implications in the context of teaching and learning. Teachers and teachers may consider using miniature power channel media as an effective learning strategy to enhance student understanding. Those miniature media can help students to concrete concepts and processes in electricity distribution systems, thereby increasing student engagement and interest in learning.

However, it should be noted that this study was conducted at the SMKN 2 Banda Aceh with a sample of XI grade students of TJTL. Therefore, generalizing the results of this research should be done with caution. Further research with a wider sample and variation of learning contexts can provide a more comprehensive understanding of students' learning outcomes on electrical distribution system subjects, with the presence of application of miniature electrical power system teaching media to the subject.

## Conclusion

Based on the research that has been done, it can be concluded that the validity of the learning media using a miniature power channel system is confirmed through the results of the validation by the media expert, who obtains a 100% percentage, and validation of the material, who also obtained a 100% percent. These results were obtained after several revision processes. Based on media and material expert validation, miniature and teaching materials of electricity distribution systems are categorized as "very worthy" to be used in the learning process of teaching on electrical power distribution system subjects.

Based on the post-test results showing a satisfactory score with an average score of 90,00, this score is higher than the pre-test score with a average of 61.65. The result was significant through a paired sample t-test with a sig value of  $0,000 < 0,005$ .  $H_0$  rejected,  $H_a$  accepted, showing a significant difference between the samples before and after the intervention. This means that the use of miniature electrical power system teaching media has a very positive and effective impact on improving student learning outcomes on electrical distribution system subjects.

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