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Counseling on Transformer Learning Activities at SMK Kartika XIX Bandung

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ABSTRACT

Comprehending transformers is essential due to their critical function in contemporary electrical systems, including power distribution, battery charging, and diverse technological applications. This counseling aimed to enhance the educational program and deepen the understanding of SMK Kartika XIX-1 Bandung students concerning the operational principles of transformers. The employed approaches encompass the provision of resources, demonstrations, simulations, and evaluations. The results indicated that prior to the counseling, 100% of students had not participated in a transformer simulation. Following the simulation, 50% of students comprehended the concept of a transformer. This coaching is for students to comprehend the fundamental theory of transformers and to apply this information practically, so enhancing their readiness to confront workplace challenges.

Keywords: *transformers, electrical systems, demonstration, simulation*

1. INTRODUCTION

A transformer is a stationary electrical machine that uses electromagnetic induction to convert electrical energy from high voltage to low voltage or vice versa, with the ratio of primary and secondary side voltages being directly proportional to the number of turns and inversely proportional to the current to the same frequency value **(Sulistyono, & Aziz, 2017).** A transformer is a static electromagnetic electrical device that transfers or exchanges electrical energy between electrical circuits with the same frequency and conversion ratio **(Fauji, & Jamaluddin, 2018)**. A transformer is an electrical device that transfers or converts electrical energy from one or more electrical circuits to another **(Kurniawan, etc, 2017).** A transformer is an electrical device that uses magnetic coupling to transfer and convert electrical energy from one or more electrical circuits to another. It operates on the electromagnetic induction principle **(Zuhal, & Zanggischan, 2004).** A transformer is a static electromagnetic electrical device that transfers and exchanges electrical energy from one electrical circuit to another with the same frequency and conversion ratio using magnetic coupling and the electromagnetic induction principle **(Wijaya, 2000).** A transformer is a gadget composed of coils of wire whose role is to transfer power from the input portion, or main winding, to the output section, or secondary winding **(Wahyudi, 2018).**

Comprehending transformers is essential due to their critical function in contemporary electrical systems, including power distribution, battery charging, and diverse technological applications **(Sulistiyono & Azis, 2017).**
Here are several functions of transformers in contemporary electricity **(Djufri, 2021)(Suripto, 2017)**:

1. Transformers facilitate the efficient and safe transfer of electrical power from power plants to end customers by elevating the voltage for long-distance transmission and reducing it for residential use.
2. Transformers are employed in numerous devices, including cellphone chargers, to convert alternating current (AC) voltage to direct current (DC) voltage as per the device's requirements.
3. In electronic applications, transformers are utilized in diverse gadgets to modify electrical voltage according to the device's demands.

SMK Kartika XIX-1 located at Jl. Aceh No.108, Bandung, has 5 areas of expertise, namely Mechanical Engineering, Electrical Power Installation Engineering, Light Vehicle Engineering, Motorcycle Engineering and Computer Engineering. This PKM activity is attended by students specializing in Electrical Power Installation Engineering. The selection of extension materials about transformers at SMK Kartika XIX Bandung is very important because teaching in the field of electricity at SMK Kartika XIX-1 includes a basic understanding of electrical components.

Currently, the instruction on transformers at SMK Kartika XIX Bandung remains predominantly theoretical, resulting in insufficient student comprehension of practical applications. Damingun posits that substantial enhancements in Human Resources (HR) quality can be achieved through the cultivation of skills and competencies **(Damingun, 2017)**. Competence is defined as a synthesis of skills, knowledge, and attributes necessary to execute tasks to predetermined standards. It encompasses a collection of observable characteristics and skills that facilitate and augment job performance efficiency **(Rahadi, 2021).**

By integrating information, practice, and abilities related to transformers, it is anticipated that students of SMK Kartika XIX Bandung will comprehend the operation of electrical systems, the distribution and utilization of electrical energy, and the proper functioning of electronic equipment.

2. METHODOLOGY

2.1. Methods of Activities

Several methods are employed to implement community service activities, including:

a. Material Delivery
   This strategy is employed for presenting materials related to the knowledge and theoretical comprehension of electric power system networks and transformers.
b. Demonstration
   This technique directly illustrates the process of voltage reduction via a step-down transformer.
c. Simulation
   This method allows training participants to directly experiment with a step-down transformer.
d. Evaluation
   This method assesses participants' comprehension of the material presented.

2.2 Schedule of Activities

The schedule of activities was divided into three stages:

1. The preliminary stage
   The preparatory step encompasses site inspections, interviews, permits, and the development of training materials and equipment. Interviews were performed with partners in September 2024. Numerous challenges identified at the partner's site were discovered following data collection via observation and interviews. Additionally, in collaboration with the SMK Kartika XIX educators, the PKM team endeavored to identify the optimal solutions to the encountered challenges. The solutions offered to partners encompass guidance with transformer materials.
2. Stage of Training
   The training stage consisted of transformator instruction offered by the PKM team in 6 November from 09.00 - 12.00.
3. Evaluation Stage
   Evaluation Stage was carried out in this PKM activity starting from planning, continuing to the execution phase until the completion of the activity.

3. RESULTS AND DISCUSSION

The participants, totaling 8 people, were class X students at SMK Kartika XIX Bandung. The activity began with a speech from the committee and a speech from a representative of SMK Kartika XIX Bandung. Then continued with the presentation of the material by the facilitator and ended with a question and answer session between the facilitator and participants. Figure 1 shows the documentation during the presentation session, while Figure 2 shows a demonstration of the use of a step down transformer.

Figure 1. Material Delivery Session

Figure 2. Demonstration Session

The voltage reduction procedure was also practiced by the participants using a step-down transformer. Additionally, during the evaluation session, the PKM team prepared questions for the participants to answer during the question-and-answer session. The evaluation session is depicted in Figure 3.

Figure 3. Evaluation Session

During the interview with the school, the original number of participants was 16; however, only 8 attended the counseling due to unforeseen school events, resulting in a decline in attendance.

Figure 4 indicates that all participants have been exposed to educational material regarding transformers, however Figure 5 reveals that participants have never engaged in direct simulation of transformer usage.

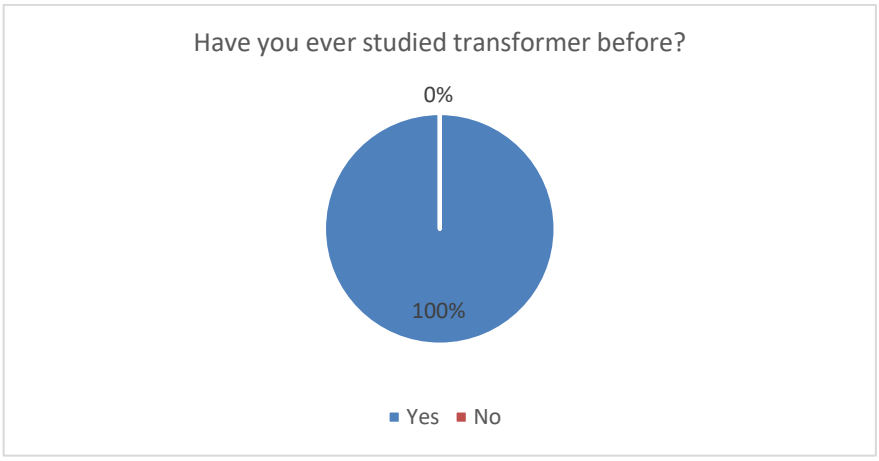

Figure 4. The percentage of Participants that Received Transformer Material

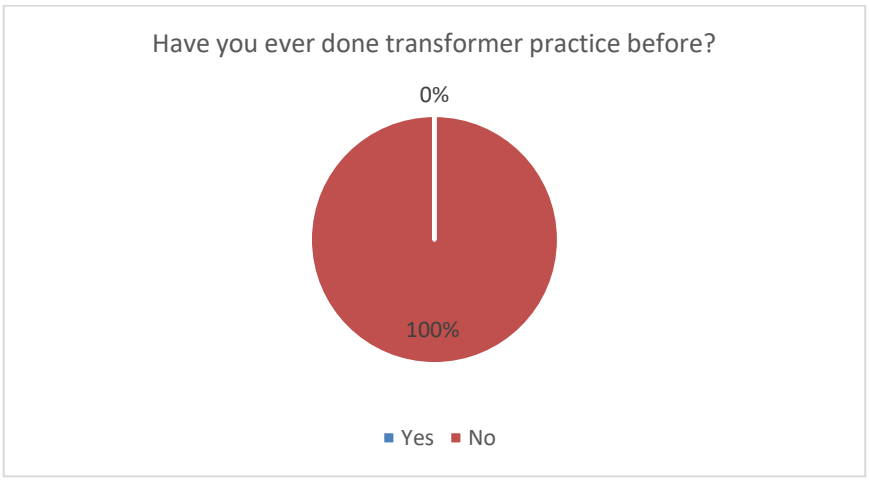

Figure 5. The Percentage of Participants Who Have Done Transformer Simulation

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The level of comprehension of participants following the transformer counseling is illustrated in Figure 6. The questionnaire results, which served as an evaluation of the training process, indicated that 12.5% of participants were still perplexed, 12.5% had a limited understanding of the subject matter, 25% had a moderate understanding, and 50% had a complete understanding of the concept.

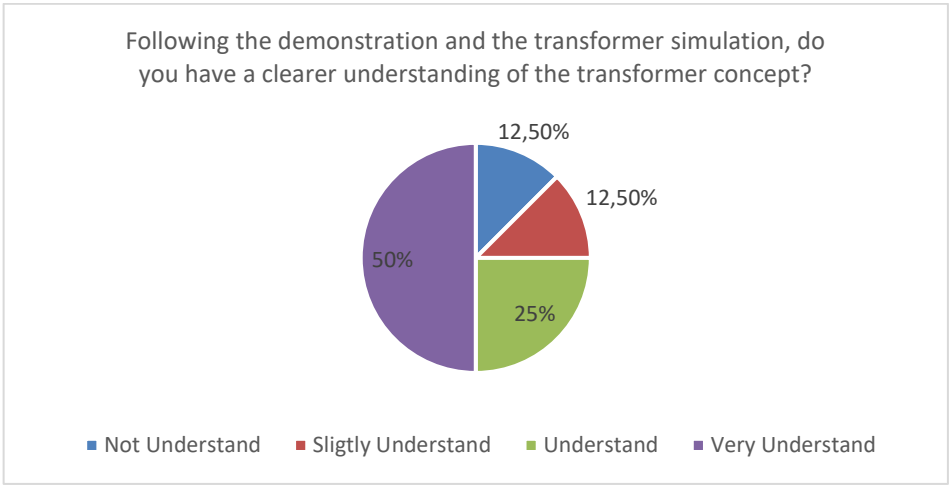

Figure 6. The Presentation of the Participants' Comprehension Following Demonstration and the Transformer Simulation

The material that was presented during the counseling session is compared to the material that was presented in the classroom in Figure 7. The questionnaire results, which served as an evaluation of the training process, indicated that the material presented during the counseling session was 50% slightly relevant, 25% relevant, and 50% very pertinent to the material taught in the classroom.

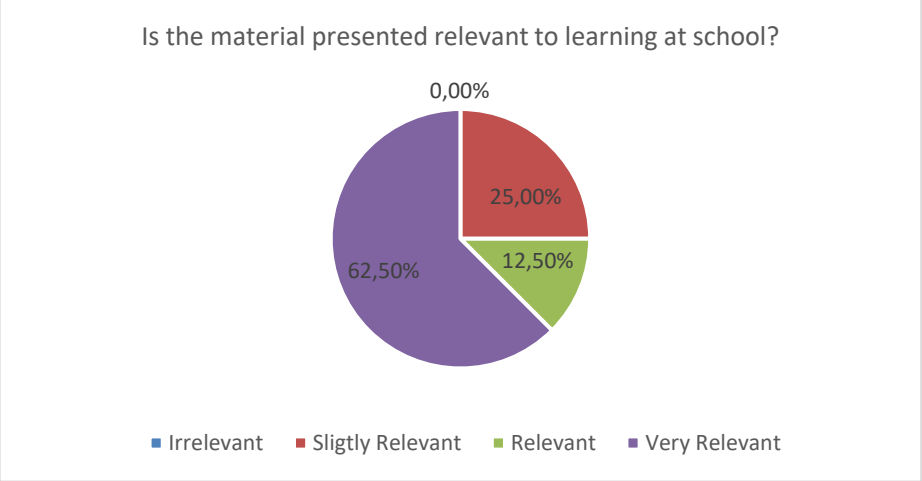

Figure 7. Presentation of the Relevation of the Counceling Material to the Transformer Topic Taught in School

Following the presentation of the content and demonstration of how the transformer works, participants were asked questions to assess their comprehension of the transformer subject. The facilitator presented each participant with a gift package including fascinating and helpful objects for those who could answer the questions, as illustrated in Figure 8.

Figure 8. Participants Who Can Answer Facilitator Questions

The counceling activity concluded with a group photo session of the participants with the facilitator, as seen in Figure 9.

Figure 9. Photo Session of Participants and Facilitators

The participants' eagerness to comprehend the material delivered by the facilitator is significantly elevated, indicating the success of this PKM activity. This session aims for participants to have a deeper understanding of transformer concepts and to use their knowledge and skills practically in the field.

4. CONCLUSIONS

The following conclusions were drawn from the PKM activity with SMK Kartika XIX Bandung participants using the transformer introductory material. Training using direct transformer simulations can improve participant's knowledge. This PKM activity was deemed successful because participants were engaged during discussions and were able to answer questions prepared by the PKM team during the question and answer session, with 75% of participants responding that the material presented during the training was very similar to what was presented at school. PKM participants thought that performing simulations improved their understanding of transformer material. Participants also expect that the facilitator will be able to perform PKM activities again at SMK Kartika XIX using PKM smart grid material.

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