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# The Influence Of Using Media Trainer Instrumentation For Monitoring System Alarms On The Learning Outcomes Maritime Electrical Cadets

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**Abstract.** Control and instrumentation engineering education plays a crucial role in preparing DIII Maritime Electrical to face the complexity of control systems in the maritime industry. In an effort to improve the quality of learning, the use of educational technologies such as media trainer instrumentation alarm monitoring systems has become the focus of research. The study aims to investigate the impact of the use of media trainer instrumentation alarm system monitoring on the learning results of the control system of the cadets. Merchant Marine Polytechnic Of Surabaya, as the leading maritime higher education institution in Indonesia, has led in integrating this technology into the learning process. By leveraging the media trainer instrumentation alarm monitoring system, they hope the cadets can gain a deep understanding of the key concepts in system control and monitoring. This research uses a quantitative data analysis approach. The control group followed conventional teaching methods, while the experimental group engaged in learning using this technology. Learning data from both groups, including test scores, tasks, and performance evaluations, were collected and analyzed. The results of this research provide valuable insights for maritime higher education institutions and practitioners in this industry. The use of trainer learning media has a significant impact on the learning outcomes of the experimental class, which reaches a higher level compared to the control class that does not use the trainer (protoboard) learning media in the Control System courses at the ETO Faculty in Merchant Marine Polytechnic Of Surabaya.

**Keywords.** Monitoring system, Learning results, Media Trainer Instrumentation, Cadets Control System

## 1. Introduction

The era of globalization has affected the advancement of complex communications technologies and human competition in the era of unlimited globalisation, thus creating the need for quality human resources capable of playing a role in the development of technology and communications[1]–[3]. Improving the quality of human resources is a necessity that must be carried out in a planned, focused, intensive, effective, and efficient manner in the development process, if we do not want this country to lose out in the globalized world. In national policy, Information and Communication Technology plays a key role in two aspects: (1) process efficiency, and (2) winning competition. The same goes for educational institutions. The

responsibility of educational institutions in entering the era of globalization is to prepare students to face all the rapidly changing challenges in our society.[4].

Merchant Marine Polytechnic of Surabaya is a state polytechnic under the auspices of the Human Resources Development Agency of the Ministry of Transportation. Its mission and function are to train maritime human resources, specifically professional sailors who are ready to work and possess skills according to international standards, particularly those set by the International Maritime Organization (IMO). Electrical Navigation, as one of the programs at Merchant Marine Polytechnic of Surabaya, has a vision to become an internationally standardized study program in implementing and developing navigation electrical technology based on information and communication technology.

As all the educational institutions under the umbrella of the Human Resource Development Agency (BPSDM) of the Ministry of Relationship which implemented the boarding school system, Merchant Marine Polytechnic of Surabaya in the organization of its educational system implemented a model of education or boarding schools, where the pupils must stay in the hostels to undergo educational process consisting of learning activities and other activities that are a simulation of life on the ship.

The cadets in the dormitory must adhere to the Daily Permanent Characteristic Orders, which regulate their activities throughout the day, from waking up in the morning to bedtime. At Merchant Marine Polytechnic of Surabaya, this boarding school combines classroom and laboratory learning with co-curricular, extracurricular activities, as well as a disciplined dormitory life pattern. However, such a lifestyle can lead to boredom and physical and mental fatigue for the students. This can affect their performance in the subjects they are studying. In addition to participating in various activities in the dormitory, the cadets must also stay focused on their main activity, which is attending lectures. Discussions with the instructors at Merchant Marine Polytechnic of Surabaya have shown that some cadets lose their enthusiasm for learning in the classroom or laboratory. Some even fall asleep due to fatigue, and their level of participation in discussions is low. This, of course, has an impact on their understanding and mastery of the teaching material, which is not optimal. A similar situation is also observed in the learning process in the Diploma III Maritime electrical program.

Learning at Merchant Marine Polytechnic of Surabaya is largely dominated by the role of lecturers, where cadets play the role of subjects in the learning process, and the learning methods are conventional. In this approach, lecturers are considered to have the most comprehensive knowledge and are the sole source of knowledge. This approach also characterizes that the management and administration of learning are entirely determined by the lecturers. Cadets have limited opportunities to express their own interests and desires, resulting in a lack of independence and motivation for self-directed learning. Everything depends on the instructions of the lecturers. The influence of dormitory life is also felt in the classroom, where learning is highly centered around the lecturers and trainers. This can also lead to a lack of independence and creativity among cadets, as everything is carried out based on instructions[5], [6].

The observation results of the learning process indicate that students face difficulties in problem-solving and achieve low learning outcomes. Merchant Marine Polytechnic Of Surabaya has implemented a competency-based curriculum that shifts the learning paradigm from lecturers as information providers (knowledge transfer) to lecturers as learning facilitators (learning triggers). In this latter role, lecturers are expected to provide opportunities for cadets to build their own knowledge through various activities, including problem-solving activities. In the learning process, cadets are not only instructed to listen and take notes, but also to engage

in activities that can change their attitudes or behaviors during the learning process. Given these issues, the researcher conducted a study on the impact of utilizing the trainer instrument alarm system in the monitoring system on the learning achievement of the control system for cadets in the Diploma III Electrical Maritime program at Merchant Marine Polytechnic of Surabaya.

## 2. Method

The researchers chose to use a quantitative approach in dealing with existing problems. Quantitative research involves the collection of data and the results of research presented in the form of figures. This approach is considered because quantitative study involves a systematic, planned, and structured process from the outset in terms of research design, including the establishment of aims, subjects, objects, data samples, data sources, and research methodologies. Variables in research can be measured with various types of scales, including nominal, ordinal, interval, and ratio scales[7]–[14].

In this approach, the researcher takes responsibility for utilizing numerical data throughout all stages of the research, from collection to presenting the final results. The involvement of these numbers guides the process of interpreting data accurately and objectively. It is important to conduct statistical analysis on the collected data so that the resulting interpretations can provide an accurate and reliable representation[14], [15].

The analyzed data is derived from the pretest and posttest results to evaluate how the use of media influences learning outcomes in the course of accommodation control maintenance and repair. The findings from this analysis will provide a comprehensive understanding of the effectiveness of media in the context of maritime education.

The type of research applied is quasi-experimental research, also known as quasi-experiments. This method allows researchers to determine whether a specific treatment has a significant impact on the research results. In practice, the experimental group will receive a particular treatment while the control group will not receive a similar treatment. Afterward, the researcher will monitor and analyze both groups to determine the impact of the treatment on the final research results[16]–[21].

By utilizing this approach, it is expected to create a comprehensive overview of the influence of media on learning outcomes in the course of maintenance and repair of ship accommodation control, which can make a positive contribution in the context of maritime education at Surabaya Merchant Marine Polytechnic. In this study, a quasi-experimental method was employed using a non-equivalent control group design. The experimental group (A) and the control group (B) were selected without random placement. Pretests and posttests were conducted on both groups. The experimental group (A) was the only group that received treatment, with the following scheme :

Group A	$O_1$ _____ X _____ $O_2$
Group B	$O_3$ _____ X _____ $O_4$

**Figure 1.** Nonequivalent Control Group Design Scheme

$O_1$  is the pretest score of the experimental group before receiving treatment, whereas  $O_2$  is the posttest score of an experimental team after receiving the treatment.  $O_3$  reflects the pretest score of a control group prior to receiving a treatment, while  $O_4$  is the postscore of a

non-treated control group. The X variable refers to the treatment given to the experimental group.

## 2.1 *Operational Definition*

### 2.1.1 *Learning Results*

The learning outcome or results is a change in behavior or an increased understanding of knowledge and experience caused by the learning process. Tests (pretest and posttest) are used to measure learning outcomes. This research considers learning as a bound variable.

### 2.1.2 *Learning Media*

Learning media can be used to deliver material that is quite challenging to convey solely through words and explanations on the whiteboard. Android applications for the experimental class and PowerPoint presentations for the control class are examples of learning media. Learning media is considered as an independent variable in this study[22]–[24].

### 2.1.3 *Pretest and Posttest*

The initial test is administered before the intervention. This test is given to both the experimental and control groups to assess the students' learning outcomes prior to the intervention. The pretest stage is also used to pilot the instrument, which is in the form of a test. The posttest, on the other hand, is the final test given after the intervention has been conducted. The posttest is used to evaluate the learning outcomes of the participants in both the control and experimental groups after the intervention[25]–[27].

### 2.1.4 *Control Class and Experimental Class Control*

The class control class uses conventional media for the learning process, while the experimental class uses an Android application for learning process[28].

## 2.2 *Sample and Population*

The research population consists of electrical cadets from three classes: electrical A, electrical B, and electrical C. Electrical classes A and C are used as control and experimental samples, and electrical class C is used as the experimental class.

## 2.3 *Research Instruments*

There are two types of instruments in this study: learning media and tests, referred to as pre-tests and post-tests. Learning media are used to differentiate between the experimental and control groups, while tests are used to measure students' abilities in the pre-test and post-test. Cadets are asked to answer history questions related to the material provided in the form of multiple-choice questions.

## 2.4 *Instrument Testing*

### 2.4.1 *Validity Testing*

Instruments that are tests, validity tests can be performed by comparing the contents of the instruments with the lessons taught. If the test instruments measure things outside the scope of the lesson, then the instrument is considered invalid[29]–[31]. To assist in content validity testing, an instrument grid can be used. Subsequently, the instrument items will be analyzed using the technique of validity testing for the learning outcome test. If variable I is

binary data and variable II is continuous data, then the point biserial correlation technique is the appropriate method to determine the correlation between them. The formula used for this is

$$r_{pbi} = \frac{Mp - Mt}{SDt} \sqrt{\frac{p}{q}} \quad (1)$$

Explanation	:
$r_{pbi}$	: Point biserial correlation coefficient indicating the strength of correlation between variable I and variable II; in this case, it is referred to as the item validity coefficient.
Mp	: Mean value of test participants who answered a specific item correctly.
Mt	: Mean score of the total scores.
SDt	: Standard deviation of the total scores.
P	: Proportion of testees who answered correctly for the item being tested for item validity.
Q	: Proportion of testees who answered incorrectly for the item being tested for item validity.

#### 2.4.2 Reliability Testing

A test is considered reliable if its results demonstrate consistency. In other words, each student will remain in the same rank order within their group if the same test is given to them at different times. Instrument reliability can be tested both externally and internally. Externally, instrument reliability can be assessed using test-retest (stability), equivalent, or a combination of both [32]–[34]. On the internal side, instrument reliability can be assessed by evaluating the consistency of the parts within the instrument using a specific method. Testing the reliability of the instrument can be done using the Kuder Richardson 21 (KR 21) formula since the data used consists of instruments with scores of 1 and 0, which are known as dichotomous:

$$r_i = \frac{k}{(k-1)} \left\{ 1 - \frac{M(k-M)}{kS_{t^2}} \right\} \quad (2)$$

Explanation	:
$r_i$	: Total number of items in the instrument.
M	: Mean total score.
Mt	: Mean score of the total scores.
$Kst^2$	: Total variance.

#### 2.5 Data Analysis Techniques

The purpose of data analysis techniques is to find solutions or answers to research questions or problems that have been formulated previously. In this study, the approach used is a quantitative approach, then the data analysis used is the statistical data analysis technique.

##### 2.5.1 Data Normality Test

The normality test in this research is conducted using the Chi-Square method. The normality test for the data using Chi-Square is done by comparing the calculated Chi-Square value with the tabled Chi-Square value. The normality test is intended to determine whether the data obtained in the research follows a normal distribution or not.

$$X^2 = \sum \frac{(f_o - f_h)^2}{f_h} \quad (3)$$

$X^2$  = chi-square

$f_o$  = observed frequency

$f_h$  = expected frequency

### 2.5.2 T-Test

In this research, the difference test is conducted using a parametric method with the requirement that the data must have a normal distribution. The testing technique employed is the t-test. The t-test is often used in experiments that involve correlated samples. Correlated samples refer to samples that have been matched in one of their variables (potentially two, three, or more variables).

### 2.5.3 Homogeneity Test

In this study, homogeneity testing is conducted using an F-test to determine if the two examined classes are homogeneous. This test is performed using the following formula:

$$F_{\text{ratio}} = \frac{\text{Largest Variance}}{\text{Smallest Variance}} \quad (4)$$

Next, the F-table is used to compare the results. After the calculation is complete, the samples are considered to have the same or homogeneous variance, with a significance level of 0.05. The degrees of freedom for the numerator (df numerator) = n - 1 and for the denominator (df denominator) = n - 1. If  $F_{\text{calculated}} \geq F_{\text{table}}$ , it means they are not homogeneous. If  $F_{\text{calculated}} \leq F_{\text{table}}$ , it means they are homogeneous.

### 2.5.4 Hypothesis Test

The decision on the hypothesis test result is made by comparing the t-test result with the t-value in the table at a 5% significance level for a one-tailed test, to determine whether  $H_0$  will be accepted or rejected. If the calculated t-value < the table t-value, then  $H_0$  is accepted, indicating that the learning outcomes of participants in the experimental class are equivalent to the learning outcomes of participants in the control class. However, if the calculated t-value  $\geq$  the table t-value, then  $H_a$  is accepted, indicating that the learning outcomes of participants in the experimental class are superior to those in the control class. To assess the extent of the impact of using the Android application learning media on the participants' learning outcomes, the difference in the average post-test scores between the control and experimental classes is calculated. This calculation will provide an overview of whether the use of the Android application significantly affects the participants' learning outcomes in the subject of KMKE. Additionally, this value can be used as a benchmark in similar studies to evaluate the influence of other learning media. The formulated statistical hypotheses are as follows:

$H_0$ : The learning outcomes of participants using the Android application learning media are the same as those of participants using PowerPoint learning media.

$H_a$ : The learning outcomes of participants using the Android application learning media are better than those of participants using PowerPoint learning media.

### 3. Result and discussion

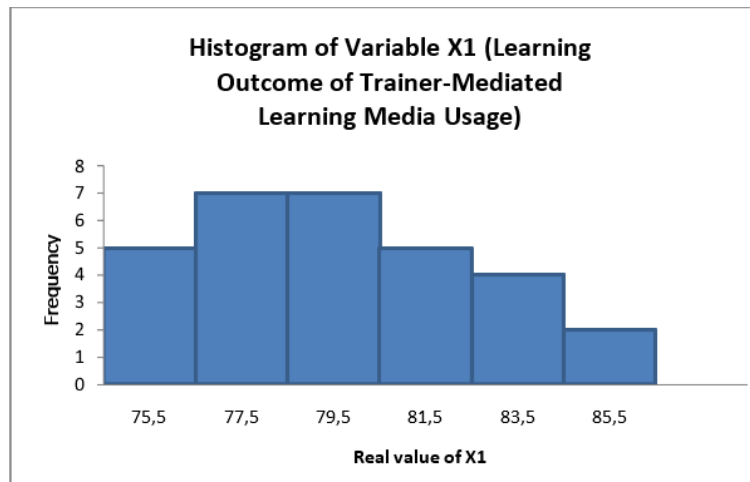
#### 3.1 Variable Data X<sub>1</sub> (Learning Outcome Of Using Trainer Learning Media)

Data on learning outcomes from the use of the training media were obtained through the completion of a research instrument using a jobsheet that covered five experiments that had undergone validation and reliability processes. This data is divided into three aspects of the research: Preparation (including completeness of work, component mastery, image mastery, and occupational safety and health factors), Practical Process (including the use of measuring tools, speed, and measurement results), and Final Results (including completion time, neatness, and cleanliness). The results of this research indicate that the highest score is 85 and the lowest is 74, with an average score ( $\bar{X}$ ) of about 78.70. The variance ( $S^2$ ) of this data is around 9.04, and the standard deviation ( $S$ ) is approximately 3.01. The frequency distribution of the learning outcome scores from using the trainer can be seen below, where the score range ( $R$ ) is 11. Based on the Sturges calculation for the number of interval classes ( $K = 1 + 3.3 \text{ Log } n$ ), the number of interval classes is:  $1 + 3.3 \text{ Log } 30 = 5.87$  rounded to 6, and the class interval length is found by dividing the score range by the number of intervals ( $R/K$ ), which is  $11 / 6 = 1.83$  rounded to 2.

**Table 1.** Variable Frequency Distribution X<sub>1</sub> (Use of Learning Media Trainer) cadets ETO Merchant Marine Polytechnic Of Surabaya

Interval Class	Lower Limit	Upper Limit	Absolute Frequency	Relative Freq. (%)
74 – 75	73,5	75,5	5	16,7
76 – 77	75,5	77,5	7	23,3
78 – 79	77,5	79,5	7	23,3
80 – 81	79,5	81,5	5	16,7
82 – 83	81,5	83,5	4	13,3
84 – 85	83,5	85,5	2	6,7
<b>Amount</b>			30	100

From Table 1, it can be seen that there are six interval classes with an interval width of 2. To determine the true boundaries of each interval, the lower boundary is calculated by subtracting 0.5 from the lower end of the interval, while the upper boundary is calculated by adding 0.5 to the upper end of the interval. The class with the highest frequency in the variable of the use of trainer learning media is located in the second (three) and third (four) interval classes, namely in the range of 76 – 77 and 78 – 79, with respective relative frequencies of about 23.3%. Meanwhile, the lowest frequency is found in the sixth (six) interval class in the range of 84 - 85, with a relative frequency of about 6.7%.



**Figure 2.** Histogram of Variable X1 (Learning Outcomes from the Use of Trainer Learning Media for ETO Cadets at Merchant Marine Polytechnic of Surabaya)

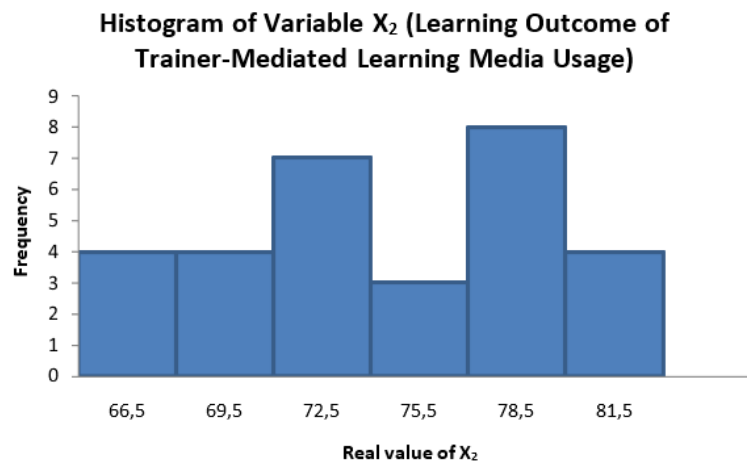
### 3.2 Variable Data X2 (Learning Outcome Of Using Trainer Learning Media)

Based on the calculations, the learning outcomes of the cadets without using the trainer ranged from a minimum score of 64 to a maximum score of 81. The average score ( $\bar{Y}$ ) is 72.96, with a variance ( $S^2$ ) of 26.86 and a standard deviation ( $S$ ) of 5.18. The frequency distribution of the cadets' learning outcomes can be seen below. The score range ( $R$ ) is 17, and according to the Sturges formula ( $K = 1 + 3.3 \text{ Log } n$ ), the number of interval classes obtained is 6 after rounding. The length of the interval class is calculated by dividing the score range by the number of classes ( $R/K$ ), which is  $17 : 6 = 2.83$ , rounded to 3.

**Table 2.** Variable Frequency Distribution X1 (Use of Learning Media Trainer) cadets ETO Merchant Marine Polytechnic Of Surabaya

Interval Class	Lower Limit	Upper Limit	Absolute Freq.	Relative Freq. (%)
64 – 66	63,5	66,5	4	13,3
67 – 69	66,5	69,5	4	13,3
70 – 72	69,5	72,5	7	23,3
73 – 75	72,5	75,5	3	10
76 – 78	75,5	78,5	8	26,7
79 – 81	78,5	81,5	4	13,3
<b>Amount</b>			30	100

Based on Table 2 of the frequency distribution, the highest frequency is obtained from 7 cadets in the interval class between 76 – 78 with a relative frequency of 26.7%. Meanwhile, the lowest frequency is in the range of 73 – 75 with a total of 3 cadets in this range. This indicates that 10% of the learning outcome scores fall within this range.



**Figure 3.** Histogram of Variable  $X_2$  (Learning Outcomes Using a Protoboard)

### 3.3 Discussion

#### 3.3.1 Analysis Prerequisite Test

Before testing the hypothesis, tests for normality and homogeneity are conducted first. From the data analysis results, the normality test values for Class A using web-based video media are obtained: The test yields a value of  $L_0 = 0.158$ ,  $L_{table} = 0.161$  with a significance level of 0.05 which is 0.161. Since  $L_0 < L_{table}$ , it can be concluded that the data in Class A follows a normal distribution. For Class B using images and modules, the test yields a value of  $L_0 = 0.113$ ,  $L_{table} = 0.161$  with a significance level of 0.05 which is  $0.132 < 0.161$ . Therefore, it can be concluded that the data in Class B also follows a normal distribution.

Next, the Homogeneity test is performed using the Fisher test. The homogeneity test, or the test for equality of variances between two population variables, yields a value of 1.90 at a significance level  $\alpha = 0.05$  with degrees of freedom for the numerator being 29 and degrees of freedom for the denominator also being 29. Since  $1.27 < 1.90$ , it can be concluded that the population variances are homogeneous, with a value of 1.72.

#### 3.3.2 Hypothesis Test

The standard deviation values for each class were found through calculations; the standard deviations for the t-test calculation are 10.972 for the t-value and 72.97 for the class B value. Based on the null hypothesis testing criteria,  $H_0$  is rejected with an infinite degree of significance, thus  $H_1$  is accepted. The research results indicate that the formulated hypothesis stating that the trainer learning media for the system subject is suitable for use as a learning medium. Cadets in class A who used the instructor learning media showed better learning outcomes, and there is a significant difference compared to cadets in class B who did not use the instructor learning media (Protoboard Panel) in the control system subject.

To test the normality of both classes with a significance level of 0.05, the obtained  $L_{table}$  value is 0.161. If the value of  $L_0$  is less than  $L_{table}$ , it can be concluded that the distribution is normal. The test results show that the experimental class has a value of  $L_0 = 0.158$  and the control class has a value of  $L_0 = 0.113$ , indicating that both classes are considered to have a normal distribution. The homogeneity test of learning outcomes using the Fisher test

yielded  $F_{hitung} = 1.72$ , with  $F_{tabel} = 1.90$  at a significance level of  $\alpha = 0.05$  and degrees of freedom = 29.

Since the calculated F-value is smaller than the tabulated F-value, the null hypothesis ( $H_0$ ) is accepted, indicating that the population variances are homogeneous. To test the hypothesis, a t-test is used. The calculated t-value obtained is 10.972, with a tabulated t-value of about 2.02 at a significance level of  $\alpha = 0.05$  and degrees of freedom = 29. Since the calculated t-value is greater than the tabulated t-value, the null hypothesis ( $H_0$ ) is rejected. Thus, the learning outcomes of the cadets in Class A who used the trainer learning media have a higher level and there is a significant difference compared to Class B, which did not use the trainer learning media (proto-board) in the subject of control systems in the ETO Department of Surabaya Merchant Marine Polytechnic.

#### 4. Conclusion

Based on the analysis and interpretation of data, as well as the statistical processing explained in the previous chapter, it can be concluded that practical learning outcomes are an evaluation of the previous learning process and are the main objective of the learning itself. These results encompass the scores obtained by cadets from the practical exercises in one of the subjects taken. The use of the trainer learning media involves utilizing a practical aid tool in the form of a trainer, which aims to accelerate and facilitate cadets in carrying out the practical exercises. The use of this trainer supports the learning process to be more effective as it provides additional experience to the cadets in conducting the practical exercises. The research results, obtained through instrument validity testing by the control systems course instructor at Merchant Marine Polytechnic of Surabaya, show a result of  $r_{ii} = 0.626$ , which aligns with the instrument interpretation table indicating high reliability. The normality test indicates that both classes have a normal distribution of data, with an L0 value of 0.158 for the experimental class and 0.113 for the control class. The homogeneity test shows that the population variances are homogeneous, with  $F_{calculated} = 1.72$  and  $F_{table} = 1.90$  at a significance level of 0.05. The t-test results show a t-calculated value of 10.972 and a t-tabled value of 2.02, indicating that  $H_0$  is rejected and  $H_1$  is accepted. Therefore, it can be concluded that the use of the trainer learning media has a significant influence on the practical learning outcomes of the experimental class cadets, reaching a higher level compared to the control class, which did not use the trainer learning media (proto-board) in the Control Systems subject in the ETO Department at Merchant Marine Polytechnic of Surabaya.

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