

The Influence of Vlaby Learning on the Process and Learning Outcomes of Cell Biology Material Practicum at SMA Negeri 2 Tondano

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Abstract: Pada pembelajaran biologi yang mengharuskan menggunakan laboratorium, sering kali siswa tidak menggunakan laboratorium dikarenakan mikroskop yang rusak. Tidak maksimalnya pelaksanaan kegiatan penunjang pembelajaran seperti kegiatan praktikum dapat membuat rendahnya aktivitas belajar dan berdampak kepada hasil belajar siswa. Upaya untuk mengatasi permasalahan tersebut adalah dengan penggunaan Virtual Laboratorium Vlaby. Tujuan penelitian ini untuk mendeskripsikan proses praktikum dan hasil belajar siswa dengan menggunakan Virtual Laboratorium Vlaby pada materi sel. Penelitian ini merupakan penelitian eksperimen semu. Penelitian ini dilaksanakan di kelas XI SMA Negeri 2 Tondano. Sampel penelitian pada penelitian ini yaitu siswa kelas XI IPA yang berjumlah 30 orang peserta didik, 15 orang kelas XI IPA 1, dan 15 orang kelas XI IPA 2. Hasil penelitian menunjukkan bahwa aktivitas praktikum kelas eksperimen menggunakan Virtual Laboratorium memperoleh kategori sangat aktif dibandingkan dengan kelas kontrol yang memperoleh kategori cukup aktif, analisis hasil belajar juga menunjukkan hal yang sama, rata-rata hasil belajar siswa kelas eksperimen memperoleh nilai sebesar 86,3 sedangkan rata-rata hasil belajar pada kelas kontrol memperoleh nilai 76,87, sehingga terdapat Pengaruh Pembelajaran terhadap Proses praktikum dan hasil belajar siswa dengan menggunakan Virtual Laboratorium Vlaby pada materi Sel di Kelas XI IPA 1 SMA Negeri 2 Tondano.

INTRODUCTION

Education is very important in preparing human beings to maintain and improve their quality of life as dignified individual nations. Education is the most important thing that determines the future of a country, where education is a tool and method to help train the personality and courage of the nation (Agustina et al., 2019; Mangelep et al., 2020). In addition,

education is increasingly diverse in its goals, functions, content, and methods (Andlini, 2021; Mangelep et al., 2023). Good education requires a variety of professional skills in its management system and requires a variety of interdisciplinary skills in solving problems (Angreani et al., 2020; Umboh et al., 2023; Mangelep et al., 2024).

The severe challenges faced in all fields can be seen from various types of reports such as student learning outcomes and the inability of the community to maintain their children's success in educational institutions to the age of compulsory learning. The evaluation system, education management, and what is most often highlighted by the mass media today are the problems of teachers, curriculum, textbooks, and learning systems where the teaching and learning process occurs (Astuti, 2016; Mangelep et al., 2023).

According to Suyanto and Asep, the teaching-learning process is a system consisting of many components that are integrated with each other to achieve goals. These components consist of teachers, learning objectives, learning materials, learning media, learning systems that include learning models and methods, learning resources, interaction management, evaluation, and students (Maulida, 2019; Bararah, 2022; Mangelep et al., 2024). All of these components need to be carefully considered in order to achieve optimal learning outcomes (Bunyamin, 2021). The educational process generally leads to three main things students can achieve: affective, cognitive, and psychomotor (Djamaluddin, 2019). Affective agreement with attitudes, morals, ethics, and emotional management (Fitri et al., 2023). Cognitive is related to aspects of thinking, knowledge transfer, logic, and analysis (Hartono & Azimata, 2019). Meanwhile, psychomotor skills relate to the practices or applications that are obtained through cognitive pathways (Ikhsan, 2019). Learning objectives describe the learning process and outcomes expected to be achieved per basic competencies (Kalisma, 2017). The learning process is designed with learner-centered to encourage motivation, interest, creativity, initiative, inspiration, independence, and learning spirit (Kurniati, 2020; Lubis, 2021; Mangelep et al., 2024).

Biology, as one part of Science Education, has undergone various changes according to the curriculum that is currently in place (K13). In the implementation of learning, teachers are required to be able to manage learning optimally and be able to develop teaching and learning activities (variations of teaching methods) not only in the classroom but also outside the classroom, for example, through practicum activities or experiments in the laboratory (Malik, 2019; Umboh et al., 2023). Process-oriented biology learning involves the active role of students in their learning activities (Mangelep, 2015; Wardah, 2022).

Class XI biology learning materials focus on human anatomy and physiology chapters. The material consists of cells, the motor system, the circulatory system, the digestive system, the respiratory system, the excretory system, the reproductive system, the sensory apparatus system, and the regulatory system in humans. These materials are abstract, especially cell materials that must be observed directly using learning tools or media that can clarify the material (Maulida, 2019; Mangelep, 2017).

Based on initial observations made at SMA Negeri 2 Tondano, the school has implemented the 2013 curriculum abbreviated as K13. However, sometimes the interaction between teachers and students is one-way, or it can be said that there is no response from students in the learning process, so many do not understand and understand the material being taught. In addition, in biology learning that requires the use of a laboratory, students often do not do practicum in the laboratory because the microscope is damaged, so biology learning that requires the use of a microscope is not carried out and only seeks sources of knowledge through school package books. The reality in the field also shows that the achievement of the number of students who complete their studies in Class XI Science of SMA Negeri 2 Tondano is still low. It is low because it has

not reached the Minimum Completeness Criteria (KKM) set at the school for biology lessons, which is ≥ 75 . Based on the background of the problem that has been described, the researcher is interested in conducting a study entitled "The Influence of Learning on the Learning Process and Outcomes of Cell Biology Material Practicum at SMA Negeri 2 Tondano".

METHODS

The research approach used in this study is a quantitative approach. Quantitative research is the systematic and objective collection of information to test hypotheses or solve problems (Razali et al., 2023). This study uses a quasi-experimental research method (Quasi-Experimental Design); the research design used is Nonequivalent Control Group Design (Rofiqoh & Zulhawati, 2020). Where the experimental group and the control group were not randomly selected. The experimental and control groups were subjected to preliminary tests. The two groups received different treatments; where the experimental group used the Virtual Vlaby Laboratory for learning, and the control group used the learning model used in school and ended with a final test for each group.

Table 1. Research Design

E	O ₁	X	O ₂
K	O ₁	-	O ₂

Description :

E : Experimental Class

K : Control Class

O₁ : Initial Test

O₂ : Final Test

X : Treatment

This research was conducted at SMA Negeri 2 Tondano, South Tondano District, Minahasa Regency, in the Even Semester of the 2023/2024 Academic Year. The population in this study is all students of grade XI of SMA Negeri 2 Tondano, while the sample is Class XI Science 1 as the Experimental class and Class XI SCIENCE II as the control class.

A research instrument is a tool used to measure observed natural or social phenomena. The instruments used in this study are observation sheets and tests. The collection of research data is carried out in two ways: Test and Non-Test. In the experimental class, the learning process is carried out in class XI Science 1 with the use of Virtual Learning of the Vlaby Laboratory.

Observation Sheet is a data collection method or technique that uses observation of the research object. Observation was done to observe students' activities while learning Cell material in the experimental class. The student activity observation sheet contains all aspects of activities observed during the practicum process. Each student is observed activity points by marking (√) on the observation sheet in accordance with the aspects that have been determined. Observations were made by observers who are observers here are biology teachers at SMA Negeri 2 Tondano.

Test questions assess students' abilities, including knowledge and skills in all teaching and learning activities. The test used is a written test that aims to determine students' ability to understand and master biology lessons. The test questions given here are pre-test (initial test) and post-test (final test).

The initial test (pre-test) is given before the learning process takes place and aims to determine the extent of the student's ability. The final test (post-test) is given after the learning process takes place and aims to determine the success of the learning method used.

After all activities are completed, the next step in this study is to analyze all the data obtained during the research. This data analysis aims to answer the research that has been formulated. The data analysis stage is the most important stage in research because it is at this stage that researchers can formulate the results of their research.

RESULTS AND DISCUSSION

A. Research Results

1. Vlaby Laboratory Virtual Activity Data

Students learning activities can be seen after observation using an observation sheet filled out by 2 observers. The observation sheet used consists of 4 aspects, namely visual activities, writing activities, listening activities, and oral activities. These four aspects are activities found in learning using virtual laboratories. The assessment categories of student learning activities consist of very active, active, moderately active, and less active. The study results showed differences in student learning activities in each aspect of student learning activities consisting of several indicators observed in both classes. The average percentage of student learning activities in the Experiment class, as many as two meetings, was 88% in the Very Active category. The results of the observation of the students' Practicum activities can be seen in Table 2.

Table 2. Virtual Practicum Activity Data of Vlaby Laboratory Experimental Class

No	Indicator	Experimental Classes				Average	%	Category
		Meeting I		Meeting II				
		f	Score	f	Score			
1	Visual Activities							
	Students observe the teacher's explanation	11	4	14	4	13	83	Highly Active
	Students observe Virtual practicum through Vlaby	13	4	15	4	14	93	Highly Active
	Students read the LKPD	12	4	13	4	13	83	Highly Active
Average		12	4	14	4	13	87	Highly Active
2	Listening Activities							
	Students listen to the teacher's explanation	11	4	14	4	13	83	Highly Active
	Students hear quiz questions	12	4	11	4	12	77	Highly Active
	Students listen to a friend's presentation	15	4	15	4	15	100	Highly Active
Average		13	4	13	4	13	87	Highly Active
3	Writing Activities							
	Students take note of material points	12	4	15	4	14	90	Highly Active
	Students take note of quiz answers	12	4	15	4	14	90	Highly Active
	Students fill out the	11	4	13	4	12	80	Highly Active

	LKPD							
Average		12	4	14	4	13	87	Highly Active
4	Oral Activities							
	Students discuss LKPD	13	3	14	4	14	90	Highly Active
	Students presenting LKPD	14	3	15	4	15	97	Highly Active
	Students give feedback	13	3	14	4	14	90	Highly Active
Average		13	3	14	4	14	92	Highly Active
Average total (%)						13	88	Highly Active

DATA PRESENTASE AKTIVITAS SISWA KELAS EKSPERIMEN

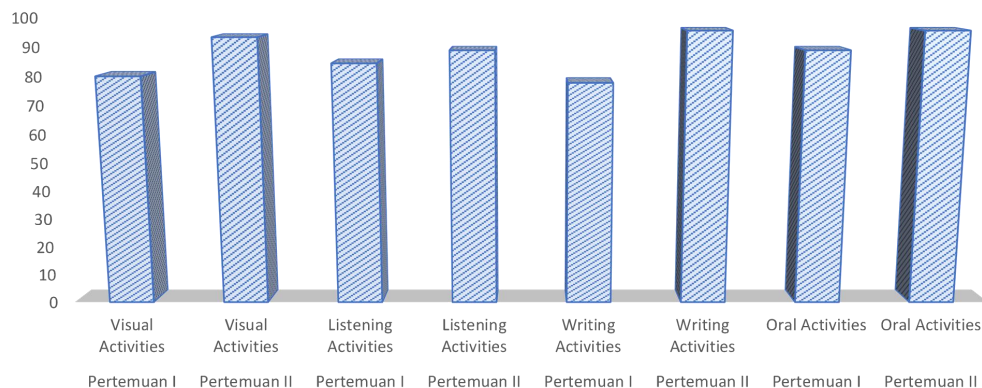


Figure 1. Percentage of Student Vlabr Practicum Activity Data

Based on the graph in Figure 1, the Vlabr Student Practicum Activity Data in the Visual Activities, Writing Activities, and Listening Activities aspects have the same percentage, which is 87%. The Oral Activities aspect followed with the highest percentage of 92%. Based on Figure 1, the average percentage of all Student Vlabr Practicum activities is 88%, with the Very Active category.

Table 3. Data on Learning Activities of Students in Control Classes

No	Indicator	Control Classes				Average	%	Category
		Meeting I		Meeting II				
		f	Score	f	Score			
1	Visual Activities							
	Students observe the teacher's explanation	6	2	8	3	7	46.67	Quite Active
	Students read the LKPD	7	3	8	3	8	50.00	Quite Active
Average		7	3	8	3	7	48.33	Quite Active
2	Listening Activities							
	Students listen to the teacher's	6	2	8	3	7	46.67	Quite Active

	explanation							
	Students hear quiz questions	4	2	6	2	5	33.33	Quite Active
	Students listen to a friend's presentation	7	3	8	3	8	50.00	Quite Active
Average		6	2	7	3	7	43.33	Quite Active
3	Writing Activities							
	Students take note of material points	4	2	6	2	5	33.33	Quite Active
	Students take note of quiz answers	6	2	8	3	7	46.67	Quite Active
	Students fill out the LKPD	4	2	6	2	5	33.33	Quite Active
Average		5	2	7	2	6	37.78	Quite Active
4	Oral Activities							
	Students discuss LKPD	6	2	8	3	7	46.67	Quite Active
	Students presenting LKPD	6	2	9	3	8	50.00	Quite Active
	Students give feedback	3	1	5	2	4	26.67	Quite Active
Average		5	2	7	3	6	41.11	Quite Active
Average Total %							42.26	Quite Active

Based on Table 3, the observation results of student learning activities in the control class obtained an average percentage of learning activities of 42% in the Moderately Active category.

In Figure 2 of the graph below, the highest percentage is in the Visual Activities aspect, 48.33%, followed by the Listening Activities and Oral Activities aspects, 43.33% and 41.11%, respectively. The lowest percentage was obtained in the Writing Activities aspect, 37.78%. Based on Figure 1, the average percentage of all learning activities of students in the control class is 42.6%, with the category of Quite Active.

DATA PRESENTASE AKTIVITAS SISWA KELAS KONTROL

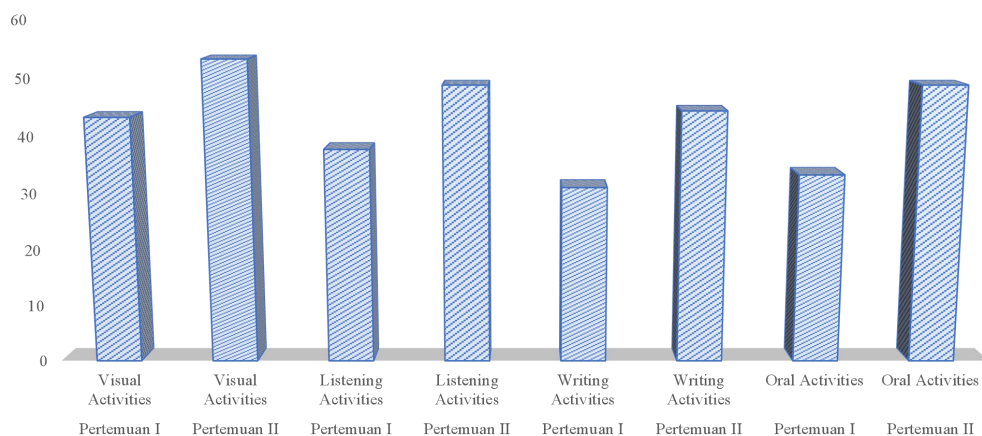


Figure 2. Percentage of Learning Activity Data of Control Class Students

2. Learning Outcome Data

The pretest and posttest scores show student learning outcomes. The results of the data analysis are in Tables 4 and 5.

Table 4. Results of Pre-test Analysis of Experimental Class and Control Class Students

Value	Experimental Classes	Control Classes
Highest	74	59
Lowest	33	35
Average	48.4	47.2
Standard Deviation	10.22	8.11

Based on Table 4, the research results on the experimental class group XI Science 1 and the control class group XI Science 2 began with a pre-test that aimed to determine students' initial abilities regarding the concept of cell matter in general. The pre-test results for the experimental class with the highest score were 74, while the highest score of the control class was 59. The average score of the experimental class was 48.4 while for the control class was 47.2. The standard deviation of the experimental class was 10.22, while the standard deviation of the control class was 8.11.

After conducting a pre-test, the researcher continued the research by teaching cell material to two classes, namely the experimental class and the control class; the two classes received different treatments. The experimental class used practicum learning using the Vlab virtual laboratory, while the control class only used the learning model applied in school. After conducting research on both classes, a final test (post-test) was carried out to determine students' abilities after being given treatment.

Table 5. Results of Post-test Analysis of Experimental and Control Class Students

Value	Experimental Classes	Control Classes
Highest	100	87
Lowest	75	60
Average	87.67	76.87
Standard Deviation	7.08	9.08

Based on Table 5, the highest score of the post-test results for the experimental class was 100, while the highest score for the control class was 87. The lowest score obtained by students in the experimental class was 75, while for the control class, the lowest score was obtained of 60. The average post-test score of the experimental class was 87.67, while for the control class, it was 76.87, and the standard deviation of the experimental class was 7.08, while for the control class, it was 9.08.

The average post-test scores of the experimental class and the control class were different, 87.67 and 76.87. This shows that there is a real difference between the learning outcomes of students in the experimental class and the control class in learning cell material using practicum with Vlab's virtual laboratory. The graph below compares the post-test scores of the experimental class and the control class.

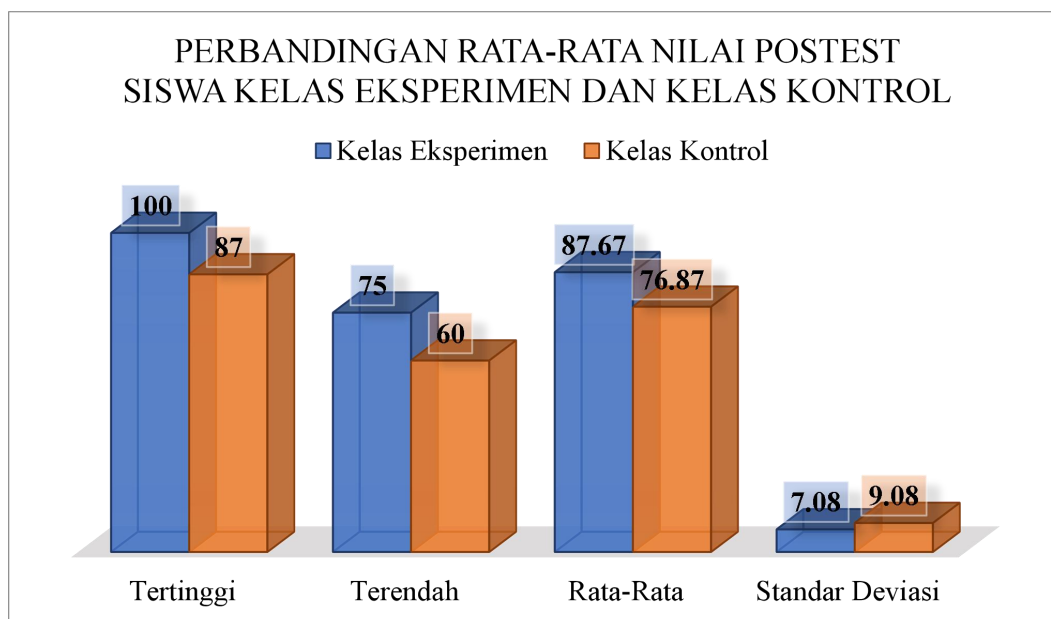


Figure 3. Average Post-test of Experimental Class and Control Class

3. Normality Test

The normality test aims to determine whether the distribution of research data is normal. The normality test illustrates that the samples taken come from a normally distributed population. The results of the normality test for the experimental class and the control class using the excel application in analyzing the liliefors test can be seen in the table below:

Table 6. Control Class Pre-test Data Normality Test

Class	Value	N	L _{count}	L _{table}	Conclusion
Experiment	Pre-test	15	0,17	0,22	Normally Distributed Samples
	Post-test	15	0,17	0,22	Normally Distributed Samples
Control	Pre-test	15	0,16	0,22	Normally Distributed Samples
	Post-test	15	0,14	0,22	Normally Distributed Samples

Table 6 shows that the results of the normality test of the Pre-test and Post-test data of Student Learning Outcomes were obtained $L_{count} < L_{table}$ values; thus, it can be concluded that the data of the two classes is normally distributed.

4. Homogeneity Test

The homogeneity test was carried out to see whether the two sample groups had homogeneous variances or not. Variance homogeneity test using Fisher test:

Table 7. Results of Pre-test and Post-test Homogeneity Tests of Control Class and Experimental Class

Homogeneity	Control Classes		Experimental Classes	
	Pre-Test	Post-Test	Pre-Test	Post-Test

Var. S	65.74	82.41	104.54	98.67
F_{count}			1.59	
F_{table}			2.48	

5. Hypothesis Test

Then to see the significant difference in the learning outcomes of students in the control and experimental classes, the researcher used the t-test.

Table 8. Results of Hypothesis Tests

t-Test: Paired Two Sample for Means

	83	80
Mean	76.42857143	88.21429
Variance	85.64835165	49.1044
Observations	14	14
Pearson Correlation	-0.290943871	
Hypothesized Mean Difference	0	
df	13	
t Stat	-3.357679277	
P(T<=t) one-tail	0.002572095	
t Critical one-tail	1.770933396	
P(T<=t) two-tail	0.005144189	
t Critical two-tail	2.16	

Based on the calculation results, a t_{count} of 0.0051 was obtained for the t_{table} with a significant level of 0.05 for both directions to 0.025, and the t-test table was obtained at 2.16. Thus, the criticism area is $t_{\text{count}} < t_{\text{table}}$, then H_0 is accepted, and it can be concluded that there is an influence of learning on the practicum process and student learning outcomes by using the Vlaby Virtual Laboratory on Cell material in Class XI of SMA Negeri 2 Tondano.

B. Discussion

This study shows that learning influences student activities and learning outcomes by using the Vlaby Virtual Laboratory on Cell material in Experimental Class XI Science 1 SMA Negeri 2 Tondano. This can be seen from the results of the analysis of activity data and student learning outcomes in the experimental class that was given the Virtual Laboratory (Vlaby) treatment received the Very Active category in the results of the observation of practicum activities, in contrast to the control class which was given a learning model used in schools without practicum received the Quite Active category, the analysis of learning outcomes also showed the same thing, in the experimental class (XI Science 1) the average learning outcome of students obtained a score of 86.3 where the average result was higher than the average learning outcome in the control class (XI Science 2) which obtained a score of 76.87.

Based on this data, it is also known that in the experimental class that was given the Virtual Laboratory (Vlaby) treatment, the highest score was 100, and the lowest score was 75, while in the control class that was only given the treatment of the learning model from the school without practicum, the highest score was 87, and the lowest score was 60.

The learning outcomes of students in grade XI Science 1 of SMA Negeri 2 Tondano who were given virtual laboratory treatment (Vlaby) got better results or scores when compared to

students in grade XI Science 2 who participated in learning only based on the learning model from the school without practicum. According to Ariani et al. (2022), learning is an activity or a process to acquire knowledge, improve skills, improve behavior and attitudes, and strengthen personality. According to Putra et al. (2024), the teaching and learning process components are related to Objectives, Content or Material, Strategy or Method, media, and Evaluation.

According to Umah (2021), the use of virtual laboratory media is not to replace the role of the real laboratory (real laboratory) but as an alternative to the incompleteness of real laboratory facilities and equipment in schools. The results of this study are in line with previous research conducted by (Rahmah et al., 2022), where there is a positive influence on improving student learning outcomes by using virtual laboratories. Research by Aripin & Suryaningsih (2020) states that the Virtual Laboratory itself is an interactive virtual learning environment that simulates practicum in a real laboratory through a computer. Virtual laboratories have advantages such as cost-effectiveness, flexibility, multi-access, ease of configuration of the system, minimizes maintenance, and is not easily damaged.

Based on this description, it is concluded that learning influences the practicum process and student learning outcomes on cell materials using a Virtual Laboratory (Vlaby) in Class XI of SMA Negeri 2 Tondano.

CONCLUSION

Based on the results of the research that has been carried out by carrying out learning through the use of the Vlaby Virtual Laboratory at SMA Negeri 2 Tondano, it can be concluded that: (1) The results of the analysis of student learning activities learned using the Vlaby Virtual Laboratory are 88% with the category of very active while the control class that uses commonly used learning obtained 42.28 with the category of quite active. Therefore, it can be concluded that learning influences the student practicum process by using the Vlaby Virtual Laboratory on Cell material in Class XI Science 1 SMA Negeri 2 Tondano. (2) The average learning outcomes of students in the experimental class who used the Virtual Laboratory Vlaby pre-test were 48.4 to 87.67 in the post-test, while in the control class that used the learning that was commonly used, the average score of the pre-test was 47.2 to 76.87 in the post-test, so it can be concluded that there is an influence of learning on the results of the student practicum by using the Virtual Laboratory Vlaby on Cell material in Class XI Science 1 SMA Negeri 2 Tondano.

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