

THE VALIDITY OF DEBATE-BASED STUDENTS WORKSHEETS**ON EVOLUTION SUBMATERIAL TO TRAIN SCIENTIFIC ARGUMENTATION SKILLS*****Validitas Lembar Kerja Peserta Didik (LKPD) Berbasis Debat untuk Melatihkan Argumentasi Ilmiah Sub Materi Evolusi*****Mas Fathimah Azzahrah**

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e-mail: dwirahayu@unesa.ac.id**Abstract**

The 21st century learning partnership requires students to have career and life skills, learning and innovative skills, information, media, and technology skills. The 2013 curriculum is linked to the demands of 21st century learning, namely the ability to have critical thinking, communication, collaboration, and creativity. The strategy that can be used to achieve these demands is to train students to argue scientifically. Students' argumentation skills must be able to understand the evidence used to connect theories, and assess the feasibility between data and arguments. One method that can be used to train scientific argumentation is debate. Therefore, this study developed a debate-based worksheet with components that include four main stages, namely constructive speech I, constructive speech II, cross-examination, and conclusion. The assessment of scientific argumentation refers to Toulmin's Argument Pattern (TAP). This research aims to describe the validity of debate-based worksheets to train students' scientific argumentation skills about evolution of the origin of living things and the theory of evolution according to the results of validation by experts. This research was conducted using the Fenrich's instructional cycle model with modification without the implementation phase due to the conditions of the Covid-19 pandemic. The results showed that the validity of the debate-based worksheets to train scientific argumentation skills was very valid. The average validation score was 3.72 based on the feasibility of presentation, content, linguistic, characteristics of the worksheets to train scientific argumentation skills and characteristics of debate-oriented worksheet. Thus, this research will be used as a basis for further research on the practicality and effectiveness of worksheets to train students' scientific argumentation skills.

Keywords: debate, worksheet, scientific argumentation skills, evolution.**Abstrak**

Kemitraan pembelajaran abad 21 mengharuskan peserta didik untuk memiliki keterampilan karir dan kehidupan, keterampilan belajar dan inovatif, keterampilan informasi, media dan teknologi. Kurikulum 2013 berkaitan dengan tuntutan pembelajaran abad 21, yaitu kemampuan berpikir kritis, berkomunikasi, berkolaborasi, dan berkreasi. Strategi yang dapat digunakan untuk mencapai tuntutan tersebut adalah dengan melatih peserta didik berargumentasi secara ilmiah. Kemampuan berargumentasi peserta didik harus mampu memahami bukti-bukti yang digunakan untuk menghubungkan teori-teori, dan menilai kelayakan antara data dan argument. Salah satu metode yang dapat digunakan untuk melatih argumentasi ilmiah adalah debat. Oleh karena itu, penelitian ini mengembangkan LKPD berbasis debat dengan komponen yang meliputi empat tahapan utama, yaitu pidato konstruktif I, pidato konstruktif II, sanggahan, dan kesimpulan. Penilaian argumentasi ilmiah mengacu pada Toulmin's Argument Pattern (TAP). Penelitian ini bertujuan untuk mendeskripsikan validitas LKPD berbasis debat untuk melatih keterampilan argumentasi ilmiah peserta didik pada materi evolusi asal usul makhluk hidup dan teori

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evolusi berdasarkan hasil validasi oleh para ahli. Penelitian ini dilakukan dengan menggunakan model siklus pengembangan instruksional Fenrich dengan modifikasi tanpa fase implementasi karena kondisi pandemic Covid-19. Hasil penelitian menunjukkan bahwa validitas LKPD berbasis debat untuk melatih keterampilan argumentasi ilmiah sangat valid. Rata-rata skor validasi sebesar 3,72 berdasarkan kelayakan penyajian, isi, kebahasaan, karakteristik LKPD untuk melatih keterampilan argumentasi ilmiah, dan karakteristik LKPD berorientasi debat. Dengan demikian, penelitian ini akan digunakan sebagai dasar untuk penelitian lebih lanjut mengenai kepraktisan dan keefektifan LKPD untuk melatih keterampilan argumentasi ilmiah peserta didik.

Kata Kunci: debat, LKPD, keterampilan argumentasi ilmiah, evolusi.

INTRODUCTION

The 21st century is an era of disruption where technological and communication advances occur very rapidly (Devi, 2018). In order to strengthen the nation's next generation to face this era, the government seeks to improve the quality of education needed by providing guidelines regarding the skills that must be possessed by students, the skills that must be achieved by students are 4C competencies, namely critical thinking and problem solving, creativity, communication skills, and the ability to work together (Kemdikbud, 2017). Critical thinking skills and communication skills are packaged into one unit in argumentation skills (Devi, 2018). Argumentation skills is one of the main objectives in science learning because students must know the scientific explanation of natural phenomena, and use it to solve problems, and capable to understanding other findings they get (Probosari, 2016).

According to Saputri (2018), Students' ability to argue are still lacking, this can be seen because students are only able to provide statements without providing scientific evidence and reasons that connect these statements. According to Jimenez-Aleixandre & Erduran (2007) said that argumentation is a solution to help students learn things that are difficult to learn, for example in evaluating evidence, and on the other hand has the potential to help teachers understand and support the learning process in science class. Muslim et al. (2013) said through the argumentation process students can learn and practice the scientific method when defending arguments.

Assessment of scientific argumentation can use Toulmin's Argument Pattern (TAP) by Toulmin (1990). Toulmin defines scientific argumentation as a pattern consisting of Data, Claim, Warrant, Backings, Qualifiers and Rebuttals (Bogar, 2019). These six aspects can be indicators to train argumentation skills. Probosari (2016) explained that TAP is considered as a pattern that can improve the quality of argumentation in the classroom

through activities to find, respond to differences and take a stand so that scientific communication in the classroom becomes more effective and minimizes student misconceptions.

Argumentation skills is the most basic ability in science. Through argumentation students can show whether a statement or theory is true or not by referring to the facts or evidence shown (Amielia, 2017). According to Deane and Song (2014) argumentation skills has an important part in developing a critical mindset and adding a deep understanding of an idea. Through argumentation skills students carry out the thinking processes and interact socially to build and evaluate other arguments.

One of the methods that can be applied to train scientific argumentation is debate. Improving communication skills, enhancing critical thinking skills, solving problems, and developing self-confidence are some of the goals of debate. Thus, scientific argumentation skills can be effectively trained through debating activities (Khaeruddin, 2017).

Debate is a discussion or exchange of opinions on a subject matter in which each participant provides reasons to defend their opinion (Nurdin, 2016). According to Silberman (2015) debate has advantages because it can arouse students' mental courage when they debate. The application of the debate method can support the 21st century education paradigm, which can assist teachers in improving learning effectiveness (Wijayanto, 2017).

Nowadays, there are still pros and cons to the theory of evolution. Different interpretations of evolutionary theory arise due to different perspectives. Explanation of the evolution of living things from the point of view of philosophy and religion are currently seen as something that contradicts the theory of biological evolution (Saputra, 2017). Evolution learning that still uses conventional learning models makes it difficult for students to understand, and the lack of curiosity of students in responding to issues surrounding

the facts and developments of evolutionary theory can have an impact on the lack of students' ability to argue (Suciati, 2015).

This can be proven from the report on the results of the 2019/2020 national final exam in biology subjects, especially evolutionary material which was classified as weak, the percentage of students who answered correctly on evolutionary material was 51.71%. One of the indicators tested was to determine examples of evolution theory according to the opinion of certain scientists (Sistem Informasi Ujian Nasional, 2019). Therefore, this finding can be used as a basis for research related to innovative learning models and strategies that can improve argumentation and scientific reasoning skills.

Based on the results of the author's interview with Mrs. Lely as a biology teacher at Khadijah Senior High School, students feel bored and less interested in the subject of evolution theory, because the learning process still uses conventional methods. So that learning goes passively. Meanwhile, in the learning process, especially the theory of evolution, the active role of students in giving their opinions is needed. Therefore, innovation is needed in learning methods that can facilitate students to think critically and enhance students' ability to argue.

Debate is one of the strategies to improve scientific argumentation skills. Scientific argumentation skills in science learning cannot occur naturally. Guidance is needed so students can practice argumentation. Based on the description mentioned above, it is important to conduct research on the development of debate-based worksheets to train scientific argumentation on evolution material for class XII. The results of the worksheets can guide students to learn argumentation skills through debate. The study aims to describe the validity of debate-based worksheets to train students' scientific argumentation skills on evolution material based on the results of expert validation.

METHOD

This development research utilized Fenrich's instructional development cycle (1997). The Fenrich's instructional cycle consists of six stages, namely Analysis, Planning, Design, Development, Implementation, and Evaluation. The analysis stage includes: curriculum analysis, student analysis, material analysis and formulation of indicators, and learning objectives. The planning stage includes detailed planning

of the worksheets structure, tools and materials used, and learning activities carried out by students on the evolution sub-material. The worksheets arranged based on the steps of the debate accompanied by argumentative activities.

The design stage was carried out by designing all the tools used in the study, such as worksheets to produce draft I and II (draft I was the origin of living things and draft II was the theory of evolution) and assessment instruments. Development was conducted by reviewing and revising the worksheets and validated by three validators (education expert lecturer, material expert lecturer and biology teacher). Development and validation were carried out at the Department of Biology Faculty of Mathematics and Natural Sciences Universitas Negeri Surabaya during January - June 2022. The evaluation stage was the supervisor provided an evaluation which was used as references for researcher to revise the worksheets. However, due to the Covid-19 pandemic, this research did not go through the implementation stage.

The validity result was obtained and interpreted based on the validity interpretation scale adapted from Ratumanan & Laurens (2006). The worksheets that had been reviewed by experts was analyzed quantitatively by calculating the average score of 3 validators and then interpreted based on Table 1 to determine the level of worksheet's validity.

Table 1. Criteria for Interpretation of Worksheet Validity

Average Score	Interpretation Criteria
>3.6	Very Valid
2.8-3.6	Valid
1.9-2.7	Quite Valid
1.0-1.8	Invalid

Source: (adapted from Ratumanan & Laurens, 2006)

RESULT AND DISCUSSION

Profile of Debate worksheets in Evolution sub material

The purpose of this study was to create debate-based worksheets in evolution theory sub-material to train students' scientific argumentation skills. The worksheets developed consists of two types, namely worksheet for students and worksheet for teachers accompanied by answer key for each question. The worksheet developed for teachers aimed to assist and facilitate teachers in implementing and using the worksheet in the learning process independently with the guidance of researchers. The worksheets were distinguished through the cover of

the worksheet, the title for the teacher's worksheet was "Kunci Jawaban LKPD" The description above is shown in Figure 1 and Figure 2.

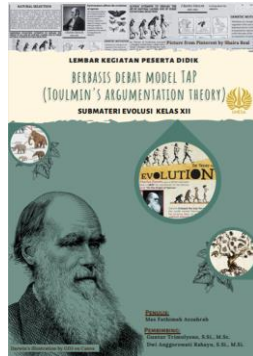


Figure 1. Worksheet for student

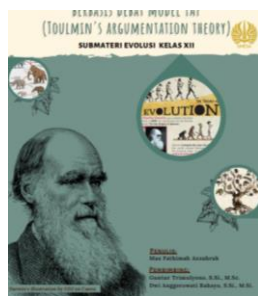


Figure 2. Worksheet for teacher

Based on the base competencies that must be accomplished by students, the evolution material is divided into several sub-materials, including the origin of living things and the theory of evolution. Therefore, debate worksheets were organized into 2 different topics, the worksheet discussed the origin of living things and the theory of evolution. However, this is relevant according to Syakrina (2012) who states that one base competency can be divided into two worksheet topics. Topics and learning objectives are presented in Figure 3 and Figure 4.

Worksheets were arranged using attractive colors and the dominance of beige and cyan colors. The selection of appropriate colors aims to increase students learning motivation in using the worksheet (Prastowo, 2015).



Figure 3. Topic of worksheets

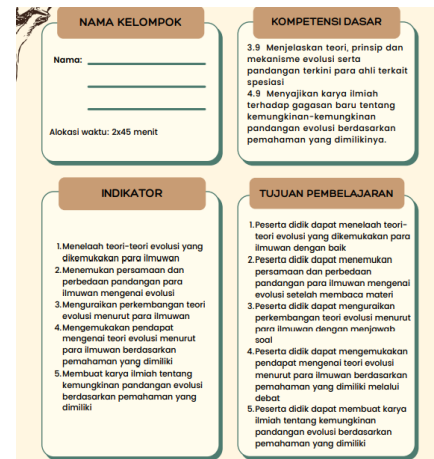


Figure 4. Learning objectives

This worksheet aims to train scientific argumentation skills accomplished through the debate model syntax. According to Hall (2011), debate has four systematic syntaxes, namely 1) constructive speech, 2) constructive speech 2, 3) cross-examination and 4) conclusion. Each component in the worksheets trains students' ability to argue. The indicators of scientific argumentation that are trained include data, claim, rebuttal, warrant, backing, and qualifiers (Bogar, 2019). The indicators of scientific argumentation and debate syntax were marked with blue icons and bolded sentences. The description above is presented in Figure 5.



Figure 5. Debate section with indicators of scientific argumentation and debate syntaxes

In addition, the worksheet was equipped with a summary of evolution material and pictures to help students understand the material well. The description is shown in Figure 6 and Figure 7.

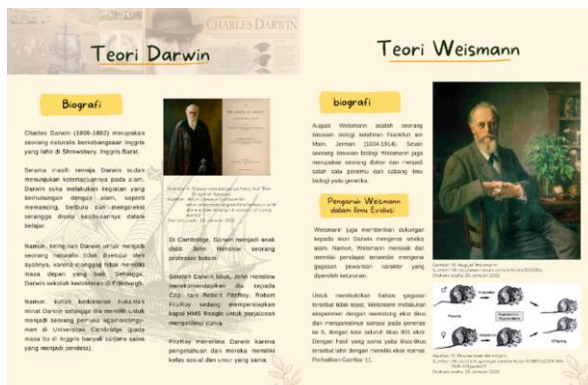


Figure 6. Theory of evolution

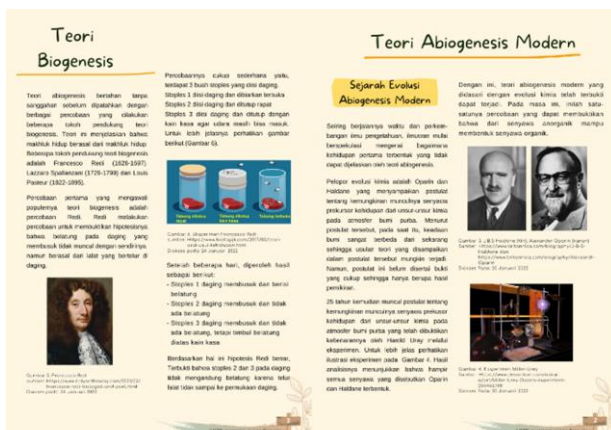


Figure 7. The origin of living things

Azhar (2011) explains that the worksheets preparation format is in accordance with basic competencies to be achieved, namely the preparation of material in accordance with the basic competencies to be achieved, namely there is an overview of the material to be learned, and the references included can help students to understand concepts well. In addition, good discourse does not find difficulties in presenting text (Zahro,

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2015). The compatibility of the worksheets preparation aims to make the worksheets effective in achieving the objectives of the worksheets which is to assist students in direct their learning interests through the activities in the worksheets (Bicer, 2016).

The worksheet was equipped with analysis questions that were given after the presentation of the material. This aims to determine the extent of students' understanding of the material provided. In addition, the worksheets was also equipped with an evaluation to assess students' level of understanding of the material after conducting debate activities. The level of student understanding can be seen from the answers given. These statements are relevant to Kamilahrohmayati (2018) who states that the requirements in developing a good worksheets consist of six important components, namely title, learning instructions, competencies to be achieved, supporting information, assignments and activity steps, and assessment. The description is shown in Figure 8 and



Figure 8. Display of analysis questions in the worksheets

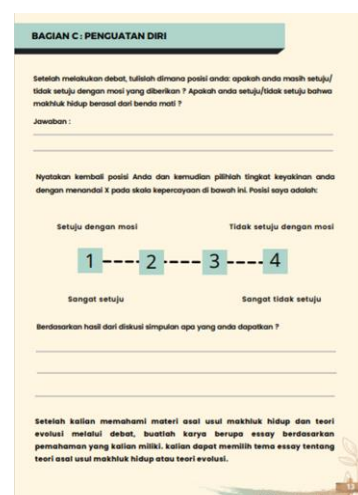


Figure 9. Display of evaluation in the worksheet

Validity of debate-based worksheet on evolution sub-materials.

The research conducted was development research to produce debate-based worksheets to train scientific argumentation skills on evolution sub-materials. This research produced worksheets on how to analyze and express opinions about the theory of evolution according to scientists. The worksheets aimed to train scientific argumentation. The argumentation assessment refers to TAP by Toulmin (1958) with elements consisting of data, claims, warrants, backing, qualifiers, and rebuttals packaged in the form of description questions. The worksheet developed was validated by three validators, namely education expert lecturer, material expert lecturer, and biology teacher to obtain a recapitulation of the worksheets data. The results of worksheets validation are shown in Table 2 below.

Table 2. Worksheets Validation Result

No	RATED ASPECT	Skor			Average	Category
		V1	V2	V3		
A. Presentation						
1	Suitability of cover to the topic	4	4	4	4	Very Valid
2	Inclusion of general instructions for activities	4	3	4	3.67	Very Valid
3	Inclusion of learning objectives	4	4	4	4	Very Valid
4	The overall presentation of the worksheet	3	3	4	3.33	Very Valid
The average score from each aspect					3.75	Very Valid
B. Linguistic						
1	Using Indonesian language in accordance with PUEBI	4	2	4	3.33	Valid
2	Language used can be understood by students	4	2	4	3.33	Valid
The average score from each aspect					3.33	Valid
C. Content						
1	Learning activities in the worksheet are in	4	3	4	3.67	Very Valid

	accordance with the demands of the 2013 curriculum which can be a reference for carrying out tasks					
2	The activities in the worksheet support the basic competencies	4	3	4	3.67	Very Valid
3	The material used is appropriate	4	3	4	3.67	Very Valid
4	Include the worksheet answer key	4	3	3	3.67	Very Valid
The average score from each aspect					3.67	Very Valid
D. The characteristics of worksheets to train scientific argumentation skills						
1	Worksheet uses the evolution sub-material by including the indicator aspect of scientific argumentation ability	4	4	4	4	Very Valid
2	The worksheets fulfill the indicators of scientific argumentation ability through the debate stage	4	4	4	4	Very Valid
The average score from each aspect					4.00	Very Valid
E. Characteristics of debate-oriented worksheets						
1	worksheet guides students to debate based on the motion	4	4	4	4	Very Valid
2	The worksheet guides students in debate	4	3	4	3.67	Very Valid
3	The	4	4	4	4	Very

	worksheet contains debate results evaluation					Valid
The average score from each aspect					3.89	Very Valid
The average score of worksheet validation					3.72	Very Valid

Information:

V1: Validator 1 (education expert lecturer)

V2: Validator 2 (material expert lecturer)

V3: Validator 3 (biology teacher)

Based on the validation results, there were several comments and suggestions given by the validators to the worksheet. The suggestion given by biology education lecturer (V1) included spelling mistakes in several words and no italics for foreign language writing. In addition, on the debate assessment indicator there was a sentence “understanding the motion” this indicator cannot be measured, because understanding is not an operational verb and “understanding” is difficult to measure its achievement. The last suggestion was that the answer key for worksheet 2 should show recent phenomena that can reflect the theory of evolution. Based on the comments and suggestions from biology education expert validator, the authors had improved these points.

Based on the results of validation from biology lecturer (V2) there were several comments and suggestions given including the images displayed blur, the procedure for writing citations on images and some images sources used were not valid, besides that the title of the image did not match the contents of the image displayed, the sentences need to be corrected so as not to cause ambiguity or double meaning, and the achievement of learning objectives on KD 4.9 had not been seen. based on the comments and suggestions on validation, the author had improved it.

The third validator was a biology teacher, based on the validation results there was comment given, namely the validator agrees if evolution is taught using the debate method so that it can stimulate students' minds to think critically, but the first step that must be done is that students must be accustomed to learning scientifically so that students are accustomed to thinking critically and all students can follow the learning well.

There were five aspects of worksheet validity assessment, namely the appropriateness of presentation, content, linguistic, characteristics of worksheets to train scientific argumentation skills, and characteristics of debate-oriented worksheets. Based on the results of the

study, the average score was 3.72 with a very valid category. This indicates that the worksheets developed has fulfilled the predetermined aspects, the worksheets can be declared theoretically feasible.

The first aspect was presentation, the presentation aspect of the worksheets received an average validity score of 3.75 which was included in the very valid category. In the presentation aspect, there are five criteria used as an assessment, namely the suitability of the cover with the topic of discussion, general instructions for activities in the worksheets, time allocation with learning objectives in the worksheets, the attractiveness of the worksheet, and references (Kamilahrohmanawati, 2018).

One component in the presentation aspect obtained a low score of 3.33. the cause of the low score was due to inappropriate color combinations and some images that were less relevant and invisible, this was corrected by the researcher with directions and suggestions from the validator. In addition, the component of the suitability of the cover with the topic of material and inclusion of learning objectives on the worksheets obtained the highest score of 4 (100%). This shows that the worksheets developed is in accordance with the criteria and requirements for making good worksheets. Six structural criteria that must be contained in the worksheets, namely titles, learning guidelines, competencies to be achieved, support information, tasks, work steps, and assessments (Azhar, 2011).

The second aspect, namely the linguistic aspect, the average score of the linguistic component obtained a result of 3.33 which was categorized as valid. The acquisition of this value shows that the debate worksheet developed used Bahasa in accordance with PUEBI (Pedoman Umum Ejaan Bahasa Indonesia), the grammar used was in accordance with SPOK (subjects, predicates, objects, descriptions), did not contain double meaning and was easy for students to understand. This was in accordance with Prastowo (2015) who said that the language used must be in accordance with the level of maturity of students, and the sentence structure used in the worksheet is easy for students to understand so that it does not cause double meanings to a statement.

Nevertheless, the worksheet required some improvements to some sentences that were unclear and not in accordance with SPOK, some sentences that were double meaning and difficult to understand. The worksheets were improved by the researcher in accordance with directions and suggestions of the validator. In addition, the worksheet developed follows

the function of worksheets according to Rosanti (2013), which functions as teaching material that can assist students in understanding the material, facilitate teachers in presenting material, and assist students in obtaining information and notes about the concepts studied.

The fourth aspect of validity was the aspect of characteristics of the worksheets to train scientific argumentation skills with reference to the TAP. The assessment component of this aspect was TAP stages, namely the data, claims, warrants, backing, rebuttals, and qualifiers stages. In the aspect of conformity with TAP method, the average score obtained was 4 which was classified as very valid. Based on these results, it shows that worksheets have fulfilled the stages of TAP and can analyze students' argumentation skills. A good application of TAP can be used as a reference in analyzing students' arguments and become a positive finding in increasing the level of students' argumentation (Kamilahrohmayati, 2018).

The last assessment aspect was the characteristic aspect of the debate-based worksheets. This aspect includes 3 things, namely guiding students to debate based on motion, guiding students in debate, and containing evaluation. The average score for this aspect was 3.89. Based on the validity value, the worksheets are declared good and can be used to train students' argumentation skills. The debate stage guides students to proceed in presenting a good argument. A good argument indicates that students understand the concept of evolution theory. Overall, the validity assessment of debate-based student worksheets was declared very valid and feasible to use as teaching materials in the learning process with an overall average value of 3.72 validity assessment.

Based on the acquisition of the validity value, the worksheets were declared good for training students' argumentation skills. The debate stage regarding TAP leads students to process in presenting good arguments. The basis of a good argument is a discourse argument that corresponds to daily arguments to facilitate the conceptualization of the formulation and the meaning of student arguments starting from case orientation to opinion conclusions (Setiawati, 2017).

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CLOSING

Conclusion

Based on the results of the study, it can be concluded that the debate-based worksheet developed to train students' scientific argumentation skills on evolution sub-materials can be used in the learning process based on the feasibility of presentation, content, linguistic, characteristics of the worksheet to train scientific argumentation skills and debate-oriented worksheet characteristics with an average result of 3.72 which is classified as very valid.

Suggestion

This worksheet development research was limited to the validation stage. Further research is needed to determine the practicality and effectiveness of the worksheets.

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