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Development Of Ethnoscience-Based E-Modules On Photosynthesis Subject For Elementary School Students

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Abstrak
Learning carried out by teachers tends to use the lecture method, using minimized image and color media so that it makes students bored, not only that teachers tend to use printed books. This type of research uses development research or R&D. The data collection techniques used are observation and interviews, validation, teacher questionnaires and student responses, the data analysis techniques used include quantitative and qualitative analysis for data collection instruments using test sheets and questionnaire sheets. E-modules are validated to experts, namely material, media and language experts, the data obtained include, among others, material expert validation of 93% with a very feasible category, media expert validation of 97% with a feasible category, and language experts of 84% with a feasible category. To measure the effectiveness of the e-module, a pretest and posttest were conducted, and a T test was conducted which showed that H0 was rejected and H1 was accepted so that there were changes that differentiated before and after treatment, it can be concluded that this media is effective to use. The results of the student questionnaire showed a value of 64% in the practical category. The results of the research conducted show that the Ethnosain-based IPAS e-module is effective as a learning support media, because the e-module can improve students' learning abilities.

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Introduction

The Ministry of Education and Culture of the Republic of Indonesia (Kemdikbud) states that 21st century learning is a learning approach designed to prepare students to face the demands of an ever-evolving era, especially in dealing with the development of technology and information. This learning emphasizes the development of 21st century skills, such as the ability to think critically, creatively, communicate, and collaborate, as well as the ability to learn independently and problem solve. The 21st century refers to learning that utilizes various learning methods, such as e-learning, self-directed learning, blended learning, and hybrid learning, where interaction occurs between learners and teachers, not only that the interaction can be online learning and can be accessed easily (Bernhardt, 2015). (Murtin 2015) believes that education in the 21st century, to ensure that students have the skills to learn and innovate by using technology and information to improve life skills (Ah-Nam & Osman, 2017). Basically, 21st century skills were adapted into the Indonesian education system through the 2013 curriculum. In addition
to the concept of 21st century skills, the 2013 curriculum adheres to two main concepts, namely the scientific approach and authentic assessment (Dag Heward-Mills, 2004).

21st Century Learning supports the use of modules in learning science in elementary schools, given the systematic nature of modules and the simpler presentation of material (Lubis et al., 2021). The importance of 21st century learning emphasizes learners to create an interesting, fun, and meaningful learning environment. Learner competencies aim to develop the ability to think critically, creatively, and effectively, but the 21st century is not the only

time, where information technology is utilized to support the learning process (Arifin, 2023). In 21st century learning, primary school teachers must be able to adapt methods, approaches, techniques, and the use of learning media to the needs of their students. This includes the utilization of technology, development of 4C skills, and student skills with a focus on 21st century learning. In addition, 21st century learning also emphasizes the development of 21st skills, including critical thinking, creative thinking, and effective communication skills (Philip, 2015).

Science learning in elementary school is one of the subjects that students learn. Science learning is taught in elementary schools because it involves several important aspects such as, understanding concepts and their applications, developing communication skills, developing curiosity, positive attitudes, and awareness and the last is developing critical thinking skills. Science learning taught in elementary schools teachers use a variety of interesting learning methods and strategies, to make learning more interesting, comprehensive, and interactive (Ahmar, 2012).

Science learning in elementary schools (SD) is a very important subject to develop scientific skills, understand the concept of learning science, and develop attitudes based on the values contained in learning. The main objectives of learning science in elementary school are to improve scientific skills, understand the concepts of learning science, and develop attitudes based on the values contained in learning (Afriana, 2016).

Given that science is a scientific discipline whose object of study is closest to human life, learning science in elementary schools is very important because it contains concepts that are useful and can be applied in everyday life (Mei wulan, 2020). Science is a field of science whose focus of study is human life. In addition, learning science in elementary school helps students become more active and think critically. The integrated thematic approach, for example, combines science materials in one theme and makes learning more interactive and active (Afriana et al., 2016).

According to (Nowsu, et al., 2017), the use of media in learning gives teachers access to new teaching paradigms, by accessing information that is difficult to obtain, categorizing difficult terms and concepts, and presenting information using various learning media. The use of media in learning can increase student motivation, accommodate students with different learning abilities, give students access to a variety of information, and introduce new learning strategies at all levels of learning.

In the educational process, the use of media is a tool that can help students achieve goals and improve their learning. Learning media can be physical objects, such as books, teaching aids, or models, as well as digital media, such as videos, animations, multimedia presentations, or interactive applications (Fitriani et al., 2016; Enni Suwarsi, 2020).The practical reality shows that the use of learning modules is still very rarely applied in learning. Furthermore, regarding the term e-module, students still do not understand what an e-module is. The reality in the field shows the lack of modules used in learning, so they are fixated on LKS books and printed books, which makes students feel bored in learning at school. In schools, teachers tend to use thick printed teaching materials as reference books in supporting learning (Roemintoyo et al., 2020; Saputra et al., 2022; Puspitarini, 2019). So that from these problems the author wants to make ethnoscience-based e-modules on photosynthesis material, the most important process on earth found in class IV Elementary School.

E-modules are electronic-based teaching materials that make it easier for students to understand teaching materials in teaching conditions that are accessed online (Wilujeng, 2021; Yasa, 2021). According to Adiputra et al., (2014) electronic module is a format for

presenting independent learning materials that are systematically arranged into the smallest learning units to achieve specific learning objectives (Widyaningrum, 2018; Winarko, et al, 2013: 60). Electronic modules are a practical and efficient learning format because they not only display text and images, but also videos through electronic computing devices (Rahayu & Sukardi).

Electronic modules mean digital-based media used in the learning process to provide opportunities for students to explore themselves in learning activities. The utilization of digital modules in the learning process is a smart solution that is believed to be able to overcome the problems that exist in learning activities (Yasa, 2014).

The e-module developed uses the Canva application as a module creation and editing, then the e-module publication uses the AnyFlip platform. AnyFlip is a website that can be used to upload modules and convert them into electronic modules. In addition, AnyFlip is a platform that can be used to

upload modules into e-modules quickly and easily. AnyFlip provides various features that allow users to convert PDF documents into e-books that can be read by turning pages like reading a physical book (Asiyah et al., 2021).

E-modules have the advantage that they can be integrated with the internet, and can directly play videos and music in the application created. In addition, e-modules also have disadvantages, namely that e-modules cannot be scribbled carelessly, because the e-module presentation is accessed online using the internet, and not all students can use the e-module due to limited facilities owned by the school. (Puspitasari, 2019; Steven, 2019). In this study, the authors will develop ethnoscience-based e-modules because the e-modules will discuss the concept of local culture by integrating community organizations (Sudarmin, 2022). According to Sudarmin (2015), ethnoscience is essentially the knowledge possessed by a region, or more specifically an ethnic group, or a particular social group (Nastiti et al., 2022; Hunter & Whiter, 1990; Ogumbynmi & Olaitan, 1998; Carrasio, 2006; Sudarmin, 2015).

Ethnoscience is a learning approach that integrates culture and science to provide meaningful learning for students. Although ethnoscience teaches students a scientific attitude, not all teachers and schools are connected to ethnic science learning (Rahmawati & Atmojo, 2021). The ethnoscience approach also reconstructs the knowledge and beliefs that develop in society and tests them scientifically. Ethnoscience-based learning can shape students' academic and critical thinking skills (Aji, 2017). According to Wikantiyoso & Tutuko (2009) and Fajarini (2014), local wisdom is a form of relationship between human behavior and the surrounding environment that is formed naturally based on the customs and advice of our ancestors. In general, local wisdom is created through a long internalization process and passed down from generation to generation as a result of interactions between the community and its environment (C. Dewi et al., 2019).

Ethnoscience is knowledge of regional and national culture. In addition, ethnoscience is a branch of cultural studies that seeks to understand how people understand nature. Local communities usually have an ideology or philosophy of life that affects their survival. The main indicators that exist in ethnoscience are the integration of modern science with local culture, as well as connecting modern science with the culture of local communities, providing a broader cultural context in understanding scientific concepts (Aza Nuralita, 2020).

The importance of ethnoscience learning is taught at school because it can be realized in various elements of teaching materials, teaching media, learning resources, and learning support. Ethnoscience learning occurs through the creation and design of a learning environment that integrates culture into the learning process.

integrate culture into the learning process. In primary school learning, ethnic studies can help students deepen their understanding of learning content and increase interest in learning (Khery, 2023). In addition, ethnoscience has several important aspects that must be considered, which are divided into six important aspects including: (1) Ethnobiology, (2) Ethnochemistry, (3) Ethnophysics, (4) Ethnomathematics, (5) Ethnomedicine, and (6) Agriculture. In the context of learning, the integration of ethnoscience can describe aspects or concepts in science learning in elementary schools. These aspects provide a foundation for understanding and appreciating cultural diversity in the context of science, and encourage good collaboration between science and local science (Haeriyah & Pujiastuti, 2022; Windiyani et al., 2023).

Research conducted by Loli Astika Dewi (2023) with the aim of improving student science learning outcomes and providing a more meaningful learning experience. The second research was conducted by Iis Mardianti (2023) with the research objective of developing an ethnoscience learning module on environmental pollution material to train junior high school students' science literacy. The third research was conducted by Devi Melawati (2022) with the research objective of creating meaningful and quality learning, and teaching students to build knowledge, so learning needs to be optimally designed by preserving local traditions or cultures that are poured into student learning. The fourth study by Samatowa (2011) with the development objective to show that ethnoscience-based science modules can increase student learning independence in Civics subjects at MAN 1 Demak (L. A. Dewi, 2022).

The novelty of the research in the e-module created is that there is an ethnoscience approach that teaches ethnoscience knowledge with learning materials. To help students gain a deeper understanding of ethnoscience. In addition, in this novelty the author also includes a local wisdom in Sanan Kerto Village, namely ecotourism, where a place that was once a bamboo forest and an abandoned reservoir is now a very impressive ecotourism site. So that the author can conclude the purpose of making an e-module, namely that the development of ethnoscience-based e-modules in IPAS learning is one of the main focuses in an effort to improve the quality of IPAS learning by integrating aspects of local culture and the surrounding environment. Furthermore, the application of ethnoscience in Sanankerto Village, Turen District is the development of the Boonpring Tourism Village, which utilizes bamboo forests and abandoned reservoirs into a beautiful tour that is visited by many tourists. According to Samsul Arifin, Chairman of Bumudez Kert Raharjo, the name Boon Pring which means "bamboo gift" comes from Sanskrit. Judging from the name, "Boon Pring" is actually located in a bamboo forest that has existed since 1978, but has not been managed properly and was only developed as an ecotourism by the local village community around 2017. Boon Pring offers a wide selection of games including flying fox, horseback riding, mini trail, archery, ATV, camping, traditional market, boat, and pedal boat.(Herman et al., 2019; Nabila Maharani Putra, 2020; Tantri Setya Rini, 2022).

Method

The research method used is the research and development method or commonly known as the Research and Development (R and D) method which according to (Sugiyono, 2012), R and D is a research method used to produce a certain product, and test the effectiveness of the product. This development research uses the ADDIE model.

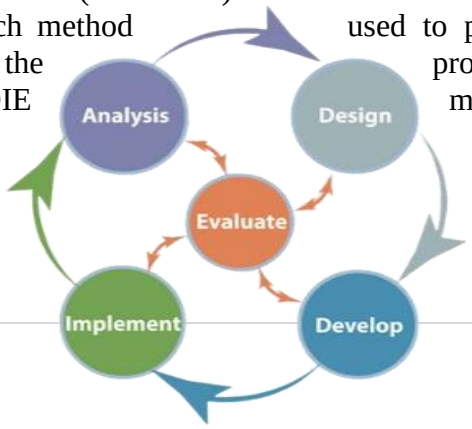

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Figure 1. Stages of the ADDIE Model

According to Puspasari (2019) the ADDIE model is a model that is often used in instructional development, this model can also be used in various forms of product development including models, learning methods, learning strategies, media and teaching materials. The research model used in this research is ADDIE development research (Analysis, Design, Development, Implementation, Evaluation). The ADDIE model was developed to conduct research in an organized manner. The main purpose of this development model is to develop an effective and efficient product (Chrisyarani & Yasa, 2018; I. Wahyu et al., 2021). The subjects of this study were 3 experts, 1 grade 4 teacher and 25 grade 4 students. The data collection instrument used was a questionnaire. The analysis techniques used were qualitative data analysis and quantitative data analysis. The design validation test was conducted to identify the shortcomings of the e-module being developed (Chrisyarani & Yasa, 2018). This research was conducted at SD Taman Siswa Turen, for the subject of this research trial consisted of 1 class teacher and a limited field test or student response, namely 15 fourth grade students of SD Taman Siswa Turen, and a limited field test from a group of 25 fourth grade students of SD Taman Siswa Turen. (Sugihartini & Yudiana, 2018; Kadek, 2018; Yohana Putri, 2020). Data collection techniques and instruments in this study include observation, interviews, validation sheets and teacher questionnaires and student responses. The data analysis technique used was quantitative and qualitative analysis (Hidayat & Nizar, 2021; Nastiti et al., 2022; Putri, Gloria Yohana, n.d.; Ramadhina & Pranata, 2022; Sugihartini & Yudiana, 2018; Zulkan, 2023).

Data collection techniques and tools in this study include observation, interviews, validation, teacher questionnaires and student responses. The data analysis techniques used include quantitative and qualitative analysis. Criteria for the feasibility of ethnoscience-based e-modules 81% - 100% percentage interval has very feasible criteria, 61% - 80% percentage interval has feasible criteria, 41% - 60% percentage interval has quite feasible criteria, 21% - 40% percentage interval has less feasible criteria, and percentage interval below 21% has very unfeasible criteria (Rukoyatun, 2018). Percentage in analyzing data with the feasibility formula. In addition, from the criteria for the practicality of ethnoscience-based e-modules where the percentage of 81% - 100% has very practical criteria, the percentage of 61% - 80% has practical criteria, the percentage of 41% - 60% has quite practical criteria, the percentage of 21% - 40% has less practical criteria, and the percentage of 0% - 20% has very impractical criteria (Sahida, 2018). Percentage in analyzing data with the practicality formula.

Results And Discussion

Stages of the ADDIE Model

Analysis

The curriculum and student needs analysis stage is part of the analysis process, which is carried out through observation, interviews, and questionnaires. Due to labor and time

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constraints, teachers tend to use blackboards and textbooks. Teaching photosynthesis material, which is the most important process on Earth, is still done through textbooks, which is cumbersome and uninteresting for students. In addition, learning usually uses lectures, questions and answers, and assignments. As a result, learning still seems teacher-centered and students are less involved. This has an impact on students' understanding of the material related to photosynthesis, which is the most important process on earth, students have difficulty determining the process of the stages of photosynthesis coherently and correctly.

Design

The product design stage consists of three stages, namely product design, product manufacturing, and preparation of validation instruments. The first step in designing this media product is to adapt the basic competency analysis that has been determined, then develop indicators and learning objectives. Referring to the KI and KD in the Regulation of the Minister of Education and Culture, this media product contains the most important photosynthesis process on earth in grade IV SD.

The presentation and preparation of this material is also adjusted to the syntax of the project-based learning model in product development. The steps of the model used are determining fundamental questions, designing product planning, scheduling, monitoring students, testing results, and evaluating (Widiarso, 2016). The next step is to design the product by determining the content of the e-module to be created and designing the cover and content template. After designing the content of the product, proceed with making the product through several stages, starting from designing the product with the Canva application. where this application can be used to create social media graphics, presentations, posters, documents and other visual contexts. So that researchers use the Canva application as a learning module. This application also provides a variety of design examples to use, making it easy to use, Canva consists of two types of services, namely free and paid. Then the author uses the Anyflip platform as a place to upload the module so that it can be accessed so that it is called an e-module.

Figure 2. Ethnoscience-Based Module

Development

At the development stage, the author designs the e-module development through the Canva Digital application. Furthermore, at this stage, validation tests were carried out to validators, such as material, language, and media experts to determine the feasibility of the e-modules being developed. Feasibility and practicality test validation data of ethnoscience-based e-modules are known through a validation sheet in the form of a questionnaire. This

data is collected to determine the level of practicality and feasibility, as well as the results of small-scale trials. The product has been validated to material expert validators, media experts, and language experts. As an assessor of the material and language developed by researchers, approval from material experts and linguists is required. on the other hand, the evaluation of the media used by the author in the development of e-modules requires approval by media experts.

Table 1. Validation Results

No	Validator	Nilai Validasi	Kategori Validasi
1.	Ahli Materi	93%	Sangat Layak
2.	Ahli Media	97%	Sangat Layak
3.	Ahli Bahasa	84%	Sangat Layak

Based on the results of some data regarding the feasibility, practicality and effectiveness of ethnoscience-based IPAS e-modules, validation was carried out to 3 experts, namely material experts, media experts and linguists. The results of validation by material experts show that the average percentage of student e-module feasibility is 93%, which means that e-modules are very feasible to use as learning media, because the material used is easy for students to understand, and there are several images and explanations that make it easier for students to understand the material conveyed in the e-module, not only that the feasibility of the material also includes the suitability of the content of the material and media with the konse and the suitability of the content of the material with the learning objectives. However, the researchers still made revisions by paying attention to the suggestions given by the validator. The improvement suggestion from the validation results of the material expert is the need to add a learning video related to the photosynthesis process in learning activities and has been revised (Amrulloh et al., 2013; Dodi, 2019; Syauqi, 2012).

The results of validation by media experts show that the average percentage of feasibility of ethnoscience-based e-modules in IPAS subjects for elementary school students is 97%, which means that ethnoscience-based e-modules are very feasible to use because they get positive responses and assessments from media experts, besides that because in terms of media and application it is very easy to apply and teach. How to use the e-module is only very easy, students only need to access through the available links to get to the e-module to be studied (Ernawati, 2017; Herawati & Muhtadi, 2018; Saski & Sudarwanto, 2021).

The results of validation by linguists show that the average percentage of feasibility of ethnoscience-based e-modules in IPAS subjects on photosynthesis material for elementary school students is 84%, which means that this ethnoscience-based e-module is feasible to use because it gets an adequate assessment from language experts, not only that the language used in e-modules is easy to understand and the writing of paragraphs and the use of punctuation and capital letters are also appropriate, making it easier for students to read existing e-modules. In the development of ethnoscience-based e-modules, the results of validation by linguists reach a decent score, indicating that the e-modules are feasible and can be used. Suggestions for improvement from the results of linguist validation are about writing capital letters, improvements in the preface, bibliography and eliminating repeated titles or appeals so as not to confuse students when reading (Amrulloh et al., 2013; Aulia et al., 2022).

Implementation

This implementation stage is carried out to conduct practicality tests by fourth grade students and teachers at SD Taman Siswa Turen. The results of the student questionnaire sheet obtained an average of 65%, meaning that the ethnoscience-based e-module occupied

the practical category, and the teacher questionnaire sheet obtained an average of 91% occupied the very practical category, so it can be concluded in terms of practicality level, this e-module has advantages in combining material in the form of learning combined with an ethnoscience approach to instill cultural values in students.

Table 2. Product Trial Results

No	Fase Uji Coba	Nilai	Kategori Kepraktisan
1.	Siswa	65%	Praktis
2.	Guru	91%	Sangat Praktis

To find out the practicality of the e-module made, the author conducted a practicality test to teachers and students, so that the results of the practicality data from the teacher's e-module obtained a percentage of 91% with very practical criteria. The percentage of product practicality is 91% of the maximum expected score with very practical criteria. Meanwhile, the results of practicality data obtained from students were 65% with a practical category (Hanafi Nurhuda Avicena, 2020; Hibban Ahsanal Fata, 2019; Fika Wahyu Nurita, 2022; Wahyudi, 2022).

Figure 3. Product Trial by Students

Based on the table of quantitative data results in this trial, the result is 65%, which means that the developed product is practical and interesting to use. The responses given by all students to the media developed as a result of product trials through a questionnaire of comments and suggestions are, 1) the display is interesting, funny, enjoyable, 2) the material is easy to understand, and 3) easy to understand. In carrying out product trials, students also showed enthusiasm and interest in using e-modules. Febriani (2022) stated that the advantages of e-modules are that they can be integrated with the internet, and can directly play videos and music in the application made. In addition, it was found that students easily used and understood this media during the trial.

Trials

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In the student response questionnaire used as a research and development instrument, on several indicators as follows, namely (1) Ease of understanding the contents of the e-module, (2) Ease of understanding e-module material, (3) Ease of use. While the attractiveness aspect focuses on several indicators, namely (1) The appearance of the e-module, (2) Colors, Images, and Effects in the e-module Book, and (3) E-modules attract students' interest in learning mathematics. There is also an aspect of readability that focuses on indicators (1) readability and (2) language understanding. Thus the developed media can be used practically and attractively (Gilang Jathi, 2022; Paramita Sari, 2022; Sutarman, 2022; Wahyudi, 2022).

Evaluation

The final stage of this development research is the evaluation stage. At this stage, the effectiveness of the developed media on student learning outcomes is tested. This study used a Pretest-Posttest Group design, in which the sample group received treatment (large variable). The initial ability is known by giving a pretest to students.

Table 3. Data Normality Test

The data normality test was conducted to determine whether the pretest and posttest data had a normal distribution or not. The normality test was carried out using JASP, here are the results of the normality test.

Test of Normality (Shapiro-Wilk)

	pretest	posttest
p- value of Shapiro-wilk	0.546	0.923

Note. Significant results suggest a deviation from normality.

Based on the results of the data normality test output conducted, it shows that the average pretest = 0.546> 0.05, so the data is normally distributed, while for posttest = 0.923> 0.05, the data is normally distributed. The next step is to conduct a T test using JASP to determine the effectiveness of the Ethnoscience-based e-module developed. The T test is conducted to test the hypothesis based on the data obtained, the following hypothesis may occur:

H0 : There is no difference in student learning outcomes before and after learning using ethnoscience-based e-modules in IPAS subjects on photosynthesis material.

H1 : There is a difference in student learning outcomes before and after learning using ethnoscience-based e-modules in photosynthesis IPAS subjects.

With the criteria, if p> 0.001 then H0 is accepted and H1 is rejected, if p < 0.001 then H0 is rejected and H1 is accepted. The following is the data from the T test results using JASP.

Table 4. T-test using JASP
Paired Samples T-Test

		t	df	p	Rata-rata Pretest	Rata-rata Posttest
Pretest	Posttest	-18,431	26	<0,001	51,875	85,257

From the table above, it is found that p < 0.001 and there is an increase in the average test score before and after learning using Ethnoscience-based e-modules in IPAS subjects on photosynthesis material. Judging from the p value, H0 is rejected and H1 is accepted. So it can

be concluded that there are differences in student learning outcomes between before and after learning using Ethnoscience-based e-modules in the subject of IPAS photosynthesis material. From these conclusions it can be said that the Ethnoscience-based e-module in the subject of IPAS photosynthesis material is effectively used as a learning support media.

Conclusion

The results showed that the ethnoscience-based e-module developed had very feasible criteria so that the e-module could be used as a learning support media at school. The practicality of the e-module is obtained which shows the practical category, meaning that the e-module can be used during learning. Judging from the effectiveness of students through existing e-modules, e-modules are quite effective in use at school because the e-modules developed have pictures that can attract students' attention, so they feel happy to learn using e-modules for students. From the results of the study, it is concluded that the ethnoscience-based e-module development product is feasible to use as a learning support process. The development of ethnoscience-based e-modules is very easy to use, because it has been tested and declared feasible for use in learning, and is beneficial for students because it contains ethnoscience-based material that can improve student learning abilities, practically and effectively. By using ethnoscience-based e-modules, students will understand the local culture in their respective villages. This ethnoscience-based e-module contains learning materials that are combined with different cultures and communities, for example in the form of tourism, nature, traditional ceremonies, so that teachers can understand the culture that exists in the material to be discussed with the student's environment.

The suggestion that the author wants to convey is that other studies should be able to develop this learning media to save costs and research time, or based on android or smartphones and online so that students are more interested in learning during learning both in the classroom and outside the classroom. For previous researchers, they should analyze various ethnoscience case studies from various societies to identify common patterns, differences, and challenges that may be faced by researchers in various cultural contexts, while for future researchers, they should examine the needs and development of local science in certain societies over time, as well as its impact on global scientific knowledge.

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