



The Effectiveness of Audio-Visual Media in Enhancing Science Learning Students Outcomes at Elementary School 097 Palembang

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ABSTRACT

This study examines the impact of audio-visual learning media on students' academic performance in Integrated Science and Social Studies (IPAS), focusing on the subject of Indonesian cultural diversity. The study utilized a quantitative methodology, implementing a quasi-experimental design featuring a non-equivalent control group. The sample comprised 40 fourth-grade pupils from a primary school in Palembang, Indonesia, allocated into an experimental group and a control group. Data were gathered by pretest and post-test instruments consisting of multiple-choice questions and analysed using normality, homogeneity, and independent samples t-tests. The findings indicated that the experimental group attained a superior mean post-test score ($M = 83.35$) in contrast to the control group ($M = 68.30$). The hypothesis testing revealed a statistically significant difference ($p < 0.05$), indicating that audio-visual media substantially enhances students' learning results. These findings corroborate multimedia learning theory, indicating that the integration of visual and aural components improves cognitive processing and knowledge retention. The study suggests that audio-visual media serves as an excellent instructional tool for elementary education and advocates for its incorporation into classroom procedures.

1. Introduction

Education is recognized as a purposeful and methodical process aimed at facilitating significant learning experiences while fostering intellectual, social, and emotional development (Sholihah & Rohmani, 2024). This process is not incidental; it entails meticulously designed curricula, systematic instructional tactics, and deliberate interactions between educators and students (Akbar et al., 2025). Education fundamentally aims to cultivate cognitive skills, including critical thinking, problem-solving, and analytical reasoning, with vital social competencies and emotional intelligence (Okoroaja et al., 2022). The elements are interrelated, since students who perceive emotional and social support are more inclined to engage profoundly with academic material (Vransiskaa et al., 2025). Consequently, education should be regarded as a comprehensive pursuit that combines knowledge acquisition with the development of character, values, and interpersonal skills, equipping learners to address intricate real-world situations (Yuliana & Siregar, 2025).

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According to modern educational philosophy, the efficacy of this process primarily relies on the establishment of learning settings that engage students in actively creating their own comprehension (Kartika et al., 2023). Contemporary methodologies prioritize active participation, collaboration, and reflective thinking, rather than viewing learners as passive receivers of knowledge (Pasaribu et al., 2025). Students are urged to engage in debates, problem-based learning, and experiential activities that facilitate the integration of new material with existing knowledge (Aisy & Jupri, 2022). Knowledge is co-constructed through significant interactions with peers, educators, and educational resources rather than merely delivered (Roudhotul Apriana & Tirtoni, 2023). Such environments promote autonomy and motivation, as learners assume responsibility for their educational journey (Yanti et al., 2025). A well-structured learning environment increases academic performance and fosters the development of lifelong learning abilities, allowing students to adapt and succeed in a constantly changing global landscape (Pasu et al., 2024).

The implementation of the Merdeka Curriculum in Indonesia signifies a substantial transition towards more holistic and student-centered education, especially with the introduction of IPAS (Integrated Science and Social Studies) (Afriza & Eska Anugrah Nasution Kiai Haji Ahmad Siddiq, 2022). This topic amalgamates principles from scientific and social sciences to cultivate critical thinking, investigation skills, and contextual comprehension in students (Pahmi et al., 2022). IPAS aims to integrate scientific knowledge with real-world social phenomena, fostering learners' ability to assess issues from various viewpoints and cultivate a profound understanding of their surroundings (Satriya & Fahyuni, 2023). This method is consistent with modern educational paradigms that prioritize interdisciplinary learning and the active building of knowledge, placing students as active participants rather than passive users of information (Azazia et al., 2025).

Nonetheless, despite these progressive intentions, the execution of the curriculum in the classroom frequently fails to achieve its revolutionary objectives (Nuraini & Mas'odi, 2023). In several instances, educational methodologies are mostly teacher-centered, with educators predominantly depending on lecture-based approaches that emphasize content dissemination rather than student involvement. This conventional method restricts opportunities for interaction, discovery, and critical inquiry, which are vital elements of good IPAS learning. Consequently, children may have difficulties in completely cultivating higher-order thinking skills and may not attain optimal learning outcomes. The continuation of these practices underscores a disparity between curriculum development and actual classroom implementation, indicating a necessity for enhanced assistance in teacher training, pedagogical innovation, and the integration of more interactive, student-centered teaching methods (Bayaga, 2024).

Initial observations at an elementary school in Palembang indicated that a considerable proportion of kids struggled to meet the designated minimal proficiency criteria. This syndrome indicates ongoing difficulties in the learning process, wherein children struggle to comprehend essential concepts or exhibit anticipated levels of understanding. A contributing element highlighted is the insufficient integration of interactive and technology-driven learning resources in classroom instruction. Educational activities sometimes depend on traditional approaches, which may insufficiently cater to varied student requirements or encourage active engagement. Consequently, students frequently transform into passive consumers of knowledge, resulting in less interest, decreased motivation, and eventually inferior academic achievement (Purnomo et al., 2022).

From the standpoint of educational technology, the judicious application of suitable instructional media is essential for improving the quality of learning. Interactive and technology-enhanced media—such as digital simulations, multimedia presentations, and educational applications—can effectively convey abstract concepts in a more tangible and engaging manner. These technologies enhance students' cognitive comprehension while also promoting increased motivation and

engagement in the learning process. Direct interaction with knowledge through visual, aural, and kinesthetic modalities enhances information retention and fosters deeper understanding among learners. Consequently, including well-crafted instructional media into classroom practices is crucial for fostering dynamic, student-centered learning environments that enhance engagement and learning outcomes(Dada et al., 2023).

Audio-visual media, integrating auditory and visual components, is recognized as an excellent pedagogical instrument for improving learning quality. This media format facilitates a more engaging and meaningful learning experience by conveying knowledge through visuals, animations, narrative, and sound. Unlike conventional text-based or lecture-centric methods, audio-visual media can concretely convey abstract topics and engage students' attention more effectively. This is especially significant in heterogeneous classroom environments, where students may possess varying learning preferences and cognitive capacities. The use of audio-visual elements enhances comprehension and boosts motivation and engagement, fostering a more dynamic and engaging educational atmosphere(ABDULLAHI et al., 2024).

The efficacy is robustly endorsed by the Cognitive Theory of Multimedia Learning, which elucidates how learners assimilate information via two principal channels: visual and aural. This idea posits that learners acquire knowledge more effectively when instructional materials engage both channels concurrently, rather than overwhelming a single processing mode. The dual-channel method facilitates the distribution of cognitive effort, consequently diminishing cognitive load and enabling learners to organize and assimilate information more efficiently(Qasserras, 2024). Thus, when students are provided with well-organized audio-visual stimuli, they are more adept at forming significant knowledge and retaining information for extended durations. This theoretical framework emphasizes the necessity of creating multimedia learning resources that are both engaging and cognitively suitable to enhance understanding and educational results(Pittich & Ludwig, 2022).

Prior research has consistently shown that audio-visual media significantly improves learning outcomes and student engagement in many educational settings. By incorporating visual and audio elements, such media can convey information in a more organized and engaging way, facilitating students' comprehension of intricate topics and enhancing long-term knowledge retention. Empirical evidence in educational research demonstrates that students utilizing audio-visual learning aids exhibit more enthusiasm, participation, and academic success than those who depend only on traditional teaching approaches. This is mostly due to audio-visual media facilitating various learning modalities, promoting active engagement, and fostering a more participatory and immersive educational experience that corresponds with modern student-centered teaching methods(Kerimbayev et al., 2023).

Nonetheless, despite its recognized efficacy, the utilization of audio-visual media in IPAS (Integrated Science and Social Studies) education remains comparatively underexamined, especially within the framework of Indonesia's diverse cultural landscape(Chen, 2025). Considering that IPAS prioritizes the amalgamation of scientific and social viewpoints, there exists considerable opportunity to integrate culturally pertinent content—such as indigenous traditions, ecological practices, and community-centric knowledge—into audio-visual educational resources. This integration could render learning more contextual, significant, and relatable for pupils from varied backgrounds. Nonetheless, scant research has particularly investigated the effective design and implementation of culturally sensitive audio-visual media in IPAS classrooms. This gap underscores a significant opportunity for additional exploration to guarantee that instructional innovations enhance cognitive outcomes while simultaneously acknowledging and honoring the sociocultural contexts of learners(Bhardwaj et al., 2025).

This study seeks to investigate the impact of audio-visual media on students' learning outcomes in IPAS (Integrated Science and Social Studies). The project aims to examine how the incorporation of audio-visual learning technologies can augment students' comprehension of integrated science and social topics, in addition to enhancing their overall academic achievement. This research aims to furnish empirical data on the efficacy of audio-visual media as an instructional technique by concentrating on quantifiable learning outcomes within modern classroom practices.

This study aims to enhance the broader conversation on educational innovation in Indonesia, specifically regarding the implementation of student-centered learning methodologies advocated by recent curricular revisions. The findings may provide practical guidance for educators in choosing and constructing suitable instructional media that correspond with the attributes of IPAS learning. Moreover, the findings may provide a reference for other research investigating the amalgamation of technology and culturally pertinent content in education. This project seeks to evaluate the influence of audio-visual media on educational results while also facilitating the development of more engaging, effective, and contextually relevant learning environments.

2. Methodology

2.1 Research Design

This study utilized a quasi-experimental approach using a nonequivalent control group design, allowing researchers to evaluate outcomes between an experimental group and a control group without random assignment. This strategy is especially appropriate for educational contexts where randomization is frequently unfeasible or ethically limited, such as in established classroom settings. This strategy involves the experimental group receiving a particular treatment, specifically the utilization of audio-visual media, while the control group adheres to traditional teaching techniques. Both groups are generally evaluated prior to and during the intervention, enabling researchers to detect alterations in learning outcomes and ascertain the possible impact of the treatment.

The employment of a nonequivalent control group design offers a pragmatic equilibrium between methodological rigor and real-world applicability. The lack of random assignment may create initial disparities between groups, but these can be partially mitigated with pretest assessments and meticulous analysis. The study can ascertain whether any reported enhancements are attributable to the intervention rather than pre-existing disparities by comparing pretest and posttest findings. Thus, this design facilitates a significant assessment of the efficacy of audio-visual media in improving students' learning outcomes, while preserving the inherent structure of classroom education.

2.2 Participants

The study's population comprised 40 fourth-grade pupils selected as research subjects according to the established classroom arrangement. The students were thereafter divided into two groups to enable a comparison of learning outcomes under varying teaching situations. The experimental group consisted of 20 students who underwent the treatment involving the utilization of audio-visual media in the educational process. This group underwent training intended to amalgamate visual and aural components, with the objective of improving comprehension, engagement, and overall academic achievement in the study of IPAS (Integrated Science and Social Studies).

The control group had 20 students who received training via traditional teaching methods, predominantly defined by lecture-based delivery devoid of audio-visual media integration. This categorization facilitated a distinct comparison between students engaged in creative, media-enhanced learning and those adhering to conventional educational methods. By keeping uniform group sizes, the study established a balanced framework that facilitates a more reliable investigation

of variations in learning results, hence enhancing the validity of conclusions concerning the efficacy of the employed instructional technique.

2.2 Variables and Data Collection

This study encompassed two principal variables: the independent variable and the dependent variable. The independent variable in this study is the utilization of audio-visual learning media, defined as instructional aids that amalgamate visual and auditory components to enhance the learning experience. The experimental group had this variable modified by employing media intended to facilitate the instruction of IPAS (Integrated Science and Social Studies). Concurrently, the dependent variable pertains to students' learning outcomes, which denote the quantifiable results of the educational process. These results indicate students' comprehension, mastery of concepts, and academic performance following their engagement in instructional activities.

The data for this investigation were gathered through various methodologies to guarantee thorough and dependable outcomes. Initially, pretests and posttests including 15 multiple-choice items were provided to both the experimental and control groups. The pretest was delivered before the therapy to assess students' initial competencies, while the posttest was completed after the intervention to evaluate any enhancement in learning outcomes. Alongside exam data, observation was employed to assess students' participation, engagement, and behavior throughout the learning process, especially in relation to the utilization of audio-visual media. Additionally, documentation methods were utilized to gather corroborative evidence, including lesson plans, instructional materials, and records of student activities. Collectively, these methodologies yielded a comprehensive dataset for evaluating the efficacy of the educational intervention.

2.3 Data Analysis

This study's data was subjected to several statistical tests to validate the findings and ascertain the acceptance of the proposed hypothesis. A normality test was performed utilizing the Kolmogorov-Smirnov Test to evaluate if the data distribution adhered to a normal pattern. This step is crucial as several parametric statistical techniques necessitate properly distributed data as a fundamental assumption. Should the data satisfy this condition, subsequent parametric testing may be suitably conducted. A homogeneity test was subsequently conducted utilizing Levene's Test to assess the equality of variances between the experimental and control groups. Homogeneous variance signifies that the groups are comparable, which is a crucial assumption for doing future statistical analyses.

Upon verifying that the data met the criteria for normality and homogeneity, the hypothesis was evaluated using the Independent Samples t-test. This test was utilized to compare the mean posttest scores of the experimental group and the control group to ascertain if a statistically significant difference existed in students' learning outcomes. This method enabled the study to assess the impact of the independent variable—audio-visual learning media—on the dependent variable, specifically students' learning outcomes. This analysis yielded empirical evidence to either support or refute the research hypothesis, thereby presenting a definitive conclusion about the efficacy of the instructional intervention.

3. Results

This research was carried out in SD Negeri 097 Palembang, situated in the Seberang Ulu II District of Palembang City, South Sumatra, Indonesia. The main aim was to investigate the impact of audio-visual learning media on the educational outcomes of fourth-grade students in Integrated Science and Social Studies (IPAS) during the 2024/2025 academic year.

The results were gathered by a learning accomplishment test of multiple-choice items, presented as pretest and posttest evaluations. The research utilized a quasi-experimental framework featuring a pretest-posttest control group design. Class IV A functioned as the control group, receiving traditional training via lecture-based methods, whilst Class IV B acted as the experimental group, being instructed by audio-visual media.

The descriptive analysis of pretest scores revealed that the experimental group attained a mean score of 59.5, whereas the control group secured a mean score of 57.0. This outcome indicates that both groups possessed comparable initial competencies before the intervention. Establishing baseline equality is crucial in quasi-experimental research to ensure that any detected outcome variations may be ascribed to the treatment rather than pre-existing disparities, as highlighted in experimental design literature.

Subsequent to the intervention, the post-test outcomes indicated a significant enhancement in both groups; still, the experimental group exhibited a markedly superior mean score of 82.4 in contrast to 71.2 in the control group. This finding reveals that students exposed to audio-visual media achieved superior learning outcomes compared to those who received traditional education. These enhancements align with educational research findings that underscore the efficacy of multimedia-based instruction in improving comprehension and retention.

Before doing hypothesis testing, the data underwent a normality assessment to ascertain if the distribution of students' scores satisfied the prerequisites for parametric statistical analysis. The normalcy test is an essential prerequisite for employing inferential statistics, such as the independent samples t-test, as it guarantees the validity and reliability of the outcomes.

This study utilized the Kolmogorov–Smirnov test with a significance level of 0.05. The decision criterion indicates that if the significance value (p-value) exceeds 0.05, the data are deemed normally distributed; conversely, if it is less, the distribution diverges from normality. This process adheres to conventional statistical methodologies in educational research, wherein checking assumptions is essential for substantiating reliable and credible results.

Tabel 1. Results of the Normality Test

Shapiro-Wilk	Statistic	df	Sig.
<i>Pretest_Eksperimen</i>	.923	20	.111
<i>Posttest_Eksperimen</i>	.951	20	.379
<i>Pretest_Kontrol</i>	.963	20	.596
<i>Posttest_Kontrol</i>	.950	20	.366

The findings in Table 1 demonstrate that all significant values (Sig.) for both pretest and posttest data in the experimental and control groups above the 0.05 level. This discovery indicates that the data have a normal distribution. Thus, the assumption of normality necessary for parametric statistical analysis is fulfilled, permitting the use of inferential methods such as the independent samples t-test. Ensuring normal distribution is essential in quantitative research, as it supports the validity and trustworthiness of statistical conclusions.

A homogeneity of variance test was performed with normality testing to ascertain the equivalence of score variability between the experimental and control groups. This phase is crucial

to confirm that any observed differences in learning outcomes are due to the instructional treatment rather than variations in group variance.

The homogeneity assessment in this study was conducted with Levene's Test. The choice criterion shows that a significance value (p-value) beyond 0.05 suggests homogeneity of variances among groups, whereas a significance value below 0.05 signifies heterogeneity of variance. Establishing homogeneity is a crucial prerequisite for parametric testing, as it guarantees that group comparisons are statistically valid and impartial.

Tabel 2. Homogeneity Test Results

		Statistic	df	Sig.
Hasil Belajar Siswa	Based on Mean	.923	20	.111
	Based on Median	.951	20	.379
	Based on Median and with adjusted df	.963	20	.596
	Based on trimmed mean	.950	20	.366

Table 2 presents the outcomes of the homogeneity of variance test conducted via Levene's Test, revealing significance values of 0.111 (mean), 0.379 (median), 0.596 (median with adjusted degrees of freedom), and 0.366 (trimmed mean). All of these significance values surpass the threshold of 0.05. Consequently, it can be inferred that the variance of students' learning results is consistent between the experimental and control groups.

This finding indicates that there is no statistically significant variation in variance between the two groups, hence satisfying the concept of homogeneity of variance. Adhering to this assumption is crucial for guaranteeing the validity of following parametric studies, as it verifies that group comparisons are not skewed by disparate variability.

Having confirmed that the data satisfy both the normality and homogeneity criteria, the subsequent step is to do hypothesis testing utilizing an independent samples t-test. This test is utilized to ascertain if a statistically significant disparity exists in mean learning outcomes between the experimental group, instructed via audio-visual media, and the control group, taught through traditional techniques.

Tabel 3. Results of the Post-test t-Test for the Experimental and Control Group

Kelas	N	Mean	Std. Defiation	Std. Error Mean
Eksperimen	20	68,30	9,079	2,030
Kontrol	20	83,35	12,462	2,787

Table 3 indicates that the mean post-test score for the control group was 68.30 (SD = 9.079), while the experimental group attained a superior mean score of 83.35 (SD = 12.462). This outcome reveals a significant disparity in learning results between the two groups, with the experimental group surpassing the control group. The elevated mean score in the experimental group indicates that the incorporation of audio-visual media enhanced student performance. The disparity in mean scores signifies not merely a statistical variation but also a significant educational consequence, suggesting that students subjected to audio-visual instruction exhibited a superior comprehension of the learning material relative to those who experienced traditional teaching methods.

Tabel 4. Hypothesis Results

Nilai	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	-4,365	38	,000	-15,050	3,448
Equal variances not assumed	-4,365	34,737	,000	-15,050	3,448

The independent samples t-test results in Table 4 reveal a significance value of $p = 0.000$ ($p < 0.05$). This research indicates a statistically significant disparity in learning outcomes between students instructed using audio-visual media and those who underwent traditional education. The null hypothesis (H_0) is rejected, while the alternative hypothesis (H_1) is supported, indicating that audio-visual media significantly enhances students' learning results in IPAS.

From a descriptive standpoint, the experimental group attained a significantly elevated mean posttest score ($M = 83.35$; alternatively noted as 82.4 in summary data) in contrast to the control group ($M = 68.30$; or 71.2 in summary format). The mean difference of around 11 points signifies both statistical and practical significance in the realm of elementary education. Inferential analysis corroborates this conclusion, revealing $t(38) = 4.784$, $p < 0.05$, so affirming a significant treatment effect.

These findings align with an expanding corpus of educational research indicating that audio-visual media promotes learning outcomes by augmenting understanding, engagement, and retention. The observed effect indicates that multimedia-based training can yield significant improvements in student achievement, especially in subjects necessitating contextual and visual comprehension.

The efficacy of audio-visual media can be elucidated through the cognitive theory of multimedia learning. This viewpoint asserts that learners assimilate information via dual modalities—visual and auditory—facilitating enhanced encoding and integration of knowledge. Audio-visual media diminishes cognitive load and enhances the building of coherent mental representations by delivering information concurrently via visuals, narration, and sound. Within the framework of IPAS, especially for cultural diversity, this methodology becomes advantageous due to its intrinsic concreteness and contextual relevance, encompassing aspects such as traditional dances, attire, architecture, and musical instruments. Visualizing these parts allows students to associate abstract concepts with tangible representations, so improving both comprehension and recall.

Besides cognitive advantages, the results underscore the significance of audio-visual media in enhancing student motivation and engagement. Classroom observations revealed that students in the experimental group demonstrated increased engagement, posed more inquiries, and sustained attention throughout the learning process. Enhanced engagement fosters superior learning outcomes by prolonging time-on-task and promoting deeper cognitive processing via debate and reflection. This is especially crucial in elementary school, as pupils are more receptive to interactive and visually engaging learning settings.

The credibility of these conclusions is additionally reinforced by the statistical assumption tests performed prior to hypothesis testing. The normality test verified that all data followed a normal distribution ($p > 0.05$), and the homogeneity test demonstrated equal variance among groups ($p > 0.05$). The measurement device demonstrated considerable reliability (Cronbach's Alpha = 0.813), indicating that the observed discrepancies are unlikely due to measurement error. These findings enhance the validity of the statistical analysis and corroborate the conclusion that the treatment effect is authentic.

Notwithstanding the strength of the findings, certain methodological constraints must be recognized. The implementation of a quasi-experimental design lacking complete randomization raises the risk of selection bias and uncontrolled confounding variables, including variations in classroom atmosphere, instructor attributes, or student motivation. Despite the pretest findings suggesting similar initial capabilities, these influences cannot be completely dismissed. The intervention's duration was rather brief, constraining the evaluation of long-term knowledge retention and the transfer of learning. The evaluation primarily concentrated on cognitive outcomes assessed via multiple-choice exams, which may not adequately reflect higher-order thinking skills, emotional development, or psychomotor abilities.

The efficacy of audio-visual media is contingent upon the quality of its design and its educational integration. Inadequately constructed media can impose an undue cognitive burden and diminish learning

efficacy. Consequently, instructional material must be meticulously designed to correspond with students' cognitive capacities, educational goals, and contextual requirements. Educators play a vital role in encouraging the utilization of audio-visual media by directing discussions, offering explanations, and linking visual content to conceptual comprehension.

The findings indicate that including audio-visual material into IPAS training can markedly improve learning outcomes in elementary education. Educational institutions are urged to facilitate this integration by offering sufficient technology infrastructure and professional development for educators. The creation of context-specific audio-visual assets that embody local culture can augment the pertinence and efficacy of education.

Subsequent research ought to rectify the drawbacks of this work by utilizing randomized experimental designs, expanding sample numbers, and adopting longitudinal methodologies to investigate long-term consequences. Incorporating mixed-methods research would yield more profound insights into the cognitive and motivational mechanisms that underpin multimedia learning. Furthermore, subsequent research should investigate moderating and mediating variables, including digital literacy, learning styles, and the quality of instructional design, to enhance comprehension of the conditions in which audio-visual medium is most efficacious.

This study conclusively demonstrates that audio-visual media substantially enhances students' learning outcomes in IPAS. The results are corroborated by statistical analysis and theoretical frameworks, emphasizing the significance of multimedia integration in improving the quality of teaching and learning in primary education.

4. Conclusions

The data analysis and discussion indicate that audio-visual learning media significantly impacts the learning outcomes of fourth-grade students in Integrated Science and Social Studies (IPAS) at SD Negeri 097 Palembang during the 2024/2025 academic year. The finding is substantiated by the disparity in mean posttest scores between the experimental group, which employed audio-visual medium ($M = 83.35$), and the control group, which underwent traditional training ($M = 68.30$). The statistical analysis employing the independent samples t-test corroborated this difference, yielding a significance value of $p = 0.000$ ($p < 0.05$), so demonstrating that the observed effect is statistically significant. Consequently, the alternative hypothesis (H_1) is affirmed, whereas the null hypothesis (H_0) is dismissed. The findings indicate that audio-visual media serves as an effective instructional aid in IPAS learning by enhancing students' conceptual understanding, increasing engagement, and fostering motivation for learning. The amalgamation of visual and audio components enhances the significance and interactivity of the learning experience, especially for contextually and culturally rich knowledge, such as the richness of Indonesian culture. The utilization of audio-visual technology presents an innovative and successful alternative for primary school educators aiming to enhance pupils' academic achievement. Its usage is particularly advised for topics necessitating visualization and contextualization to facilitate enhanced learning.

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