The Future of Learning: Exploring Hybrid Educational Models and Their Impact on Student Engagement and Performance in a Digitalized World

I Putu Putra Astawa[1], Putu Atim Purwaningrat[2]

[1]Master of Management Study Program, Faculty of Business Economics and Tourism, Bali, 82110, Indonesia

[2]Management Study Program, Faculty of Business Economics and Tourism, Bali, 82110, Indonesia

DOI: https://doi.org/10.51584/IJRIAS.2025.10040048

Received: 25 March 2025; Accepted: 29 March 2025; Published: 09 May 2025

ABSTRACT

This study examines the effectiveness of hybrid educational models in enhancing student engagement and academic performance in a digitalized world. Combining face-to-face and online learning, hybrid models utilize technological advancements to provide flexibility and personalization. Using Structural Equation Modeling-Partial Least Squares (SEM-PLS) with 140 respondents from higher education institutions, the study analyzes relationships between Hybrid Educational Models, Digital Tools, Student Engagement, and Academic Performance. Results show hybrid models significantly enhance student engagement (path coefficient = 0.582, $p < 0.001$) and academic performance (path coefficient = 0.550, $p < 0.001$). Digital tools also positively influence engagement (path coefficient = 0.192, $p = 0.018$) and performance (path coefficient = 0.271, $p < 0.001$) but with smaller effects. The interaction between Digital Tools and Hybrid Educational Models is not significant, suggesting independent contributions. The findings emphasize the effectiveness of hybrid models in addressing diverse learning needs and highlight the importance of tailored pedagogical strategies for inclusive, adaptable education in the digital era.

Index Terms: Hybrid Educational Models; Student Engagement; Academic Performance;Digital Tools; Flexible Learning Strategies

INTRODUCTION

The evolution of educational technology has significantly reshaped the landscape of education, particularly in the context of hybrid education models. Hybrid education, which combines traditional face-to-face instruction with online learning components, is increasingly recognized as a viable approach to enhance educational outcomes. This model leverages technological advancements to create a more flexible and accessible learning environment, catering to diverse learner needs and preferences.

Recent studies highlight the critical role of information and communication technology (ICT) in facilitating this transformation. For instance, Halim et al. emphasize that the integration of various technologies, including augmented reality and online applications, has become essential in modern education, reflecting a shift towards more interactive and engaging learning experiences (1). Similarly, Wang et al. discuss how the "Internet + education" model exemplifies the trend towards information-based educational reform, underscoring the necessity of innovative teaching methods that incorporate multimedia and internet technologies (2). This integration not only enhances the learning experience but also prepares students for the demands of the digital age.

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue IV April 2025

Moreover, the impact of technology on education extends beyond mere access to information; it fosters a collaborative learning environment. Hashim notes that the use of mobile devices, smartboards, and MOOCs has created a robust framework for globally accessible education, enabling students to engage with content in diverse ways (3). This collaborative aspect is further supported by research indicating that effective technology integration requires guidance from educators, who play a crucial role in facilitating student engagement and ensuring that technology serves educational objectives rather than merely acting as a substitute for traditional methods (4)

In the context of hybrid education, the flexibility afforded by technology allows for personalized learning experiences. For example, Huang's research illustrates how technology can improve educational quality in resource-limited areas, demonstrating that hybrid models can effectively address disparities in educational access (5). Furthermore, the concept of hybrid education aligns with the findings of Xu, who emphasizes the importance of developing technological leadership among educators to navigate the complexities of integrating technology into teaching practices (6). This leadership is vital for fostering an educational environment that embraces innovation while maintaining pedagogical integrity.

The future of learning, particularly in the context of hybrid educational models, hinges on understanding the importance of student engagement and the challenges and opportunities presented by the digital age. Student engagement is a critical factor influencing academic performance and motivation. Research indicates that engaged students are more likely to achieve better academic outcomes, as they actively participate in their learning processes and demonstrate higher levels of persistence and satisfaction (7). In hybrid educational settings, where both online and in-person learning modalities coexist, fostering engagement becomes even more vital. The flexibility inherent in hybrid models can enhance student agency, allowing learners to choose how they interact with course materials, which can lead to increased motivation and improved learning experiences (8,9).

However, the transition to hybrid education is not without its challenges. The COVID-19 pandemic has accelerated the adoption of online learning, revealing both the potential and pitfalls of digital education. For instance, while online platforms can facilitate access to education, they may also lead to increased sedentary behavior among students, as noted by Chu and Li, who highlight the negative impact of prolonged online learning on physical and mental health (10). This underscores the need for educational institutions to implement strategies that promote balanced engagement, incorporating physical activity and social interaction within hybrid learning frameworks.

Moreover, the digital age presents unique opportunities for enhancing educational practices. The integration of information and communication technology (ICT) into teaching can lead to more interactive and personalized learning experiences. Kaur emphasizes that the lessons learned from the rapid shift to digital education during the pandemic can inform future practices, making transitions smoother and more effective in the face of potential crises (11). Additionally, the development of digital competencies among educators is crucial for the successful implementation of hybrid models. Althubyani's study illustrates that enhancing teachers' digital skills can significantly improve their teaching practices, thereby positively affecting student performance (12).

Leadership also plays a pivotal role in navigating the complexities of hybrid education. Cortellazzo et al. argue that effective leadership in a digitalized world requires an understanding of how to leverage technology and foster innovation within educational institutions (13). This is particularly relevant as educators strive to create inclusive and engaging learning environments that cater to diverse student needs. The ability to build networks and collaborate with stakeholders can further enhance the effectiveness of hybrid educational models, ensuring that they are not merely reactive but strategically designed to meet the evolving demands of learners (14,15).

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue IV April 2025

LITERATURE REVIEW

Hybrid Education Model: Theory and Application

The hybrid education model has emerged as a significant pedagogical approach in contemporary educational settings, particularly in response to the challenges posed by the COVID-19 pandemic. This model integrates both traditional face-to-face instruction and online learning, aiming to enhance student engagement and performance while addressing the diverse needs of learners in a digitalized world.

The Importance of Student Engagement in Learning

Student engagement is a critical determinant of academic success and motivation. Engaged students are more likely to participate actively in their learning processes, leading to improved educational outcomes. Research indicates that hybrid learning environments can foster higher levels of engagement by providing students with choices regarding how they learn, which can enhance their motivation and satisfaction (16,17). For instance, Raes et al. highlight that synchronous hybrid learning can create opportunities for interactive discussions, thereby increasing student involvement and collaboration (16). Similarly, Hediansah and Surjono emphasize that maintaining coherence between in-class and online discussions is essential for effective learning in hybrid models, as it encourages active participation (17).

However, the transition to hybrid education is fraught with challenges. The rapid shift to online learning during the pandemic exposed significant gaps in technology access and digital literacy among students and educators alike. Many institutions struggled with inadequate infrastructure and support systems, which hindered the effective implementation of hybrid learning (18,19). Moreover, the lack of training for educators in utilizing hybrid teaching tools has been identified as a barrier to successful engagement (20,21) Therefore, addressing these challenges is crucial for maximizing the potential of hybrid educational models.

Challenges and Opportunities in the Digital Age

The digital age presents both challenges and opportunities for hybrid education. On one hand, the integration of technology into educational practices can enhance learning experiences by providing access to a wealth of resources and facilitating personalized learning pathways. Kovalevskaia et al. describe how cloud-based learning environments can improve educational efficiency by integrating various digital services, thereby enriching the learning experience (22). Furthermore, the flexibility of hybrid models allows for the accommodation of diverse learning styles and preferences, which can lead to better academic performance (23,24).

On the other hand, the digital divide remains a significant challenge, as not all students have equal access to the necessary technology and internet connectivity. This disparity can exacerbate existing inequalities in education, particularly for students from disadvantaged backgrounds (18,25). Additionally, the shift to hybrid learning has raised concerns about the potential loss of socialization opportunities that traditional classroom settings provide, which are vital for developing interpersonal skills (26). As educators navigate these complexities, it is essential to implement strategies that promote inclusivity and ensure that all students can benefit from hybrid learning environments.

Academic Performance and Hybrid Learning

Research indicates that hybrid learning can significantly enhance academic performance by promoting deeper learning and critical thinking skills. Essa's study highlights that hybrid learning effectively improves students' academic mindfulness and deeper learning capabilities, suggesting that students in hybrid environments develop higher-order thinking skills compared to those in traditional settings (27). This aligns with findings from Hediansah and Surjono, who emphasize that maintaining coherence between in-class and online discussions is crucial for effective learning outcomes in hybrid models (17). By facilitating interactive

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue IV April 2025

discussions and collaborative learning experiences, hybrid education can lead to improved academic performance.

Furthermore, the implementation of problem-based learning (PBL) within hybrid frameworks has been shown to foster independent learning and enhance students' problem-solving abilities. Foo et al. found that students engaged in PBL during hybrid learning exhibited better teamwork and communication skills, which are essential for academic success (28). This suggests that hybrid learning environments that incorporate PBL can effectively prepare students for real-world challenges, thereby enhancing their overall academic performance.

However, the transition to hybrid learning is not without challenges. Aguilera-Hermida notes that the sudden shift to online learning during the COVID-19 pandemic highlighted the need for students to develop self-regulating skills, which are critical for success in digital learning environments (29). Many students faced difficulties adapting to online learning without adequate preparation, which can negatively impact their academic performance. Thus, institutions must provide support and resources to help students develop the necessary skills for effective engagement in hybrid learning.

Moreover, the motivation of students plays a pivotal role in their academic performance within hybrid learning environments. Istijanto's research identifies various motivational factors that influence students' learning experiences in face-to-face, online, and hybrid settings (24). Understanding these factors is essential for educators to create engaging and supportive learning environments that foster student motivation and enhance academic outcomes. Hamdan further emphasizes that the adoption of new technologies in hybrid learning can present challenges, but addressing these hurdles is crucial for maximizing student engagement and performance (20).

METHODOLOGY

The design of this study uses a quantitative research approach. The analysis used is a multivariate statistical technique used to analyze the relationship between latent variables and indicators measured directly using SEM-PLS. SEM-PLS is particularly popular in the fields of social sciences, marketing, management, and education, due to its ability to handle data that does not meet the assumptions of normal distribution as well as small sample sizes. This study develops a structural model where digital_tools as a moderation variable. Model evaluation in PLS consists of evaluation of the measurement model (outer model); Structural model evaluation (inner model). The outer model in this study consists of reflective measurements where the variables Hybrid_Educational, Student Engagement, digital_tools, and Academic Performance, these four variables are measured reflectively. The evaluation of the measurement model consists of: loading factor >0.60; composite reliability >0.70; Crombat's alpha and AVE(>=0.5), as well as the evaluation of the validity of the discrimination by cross loading (30).

The population of this study is students in Bali. The sampling method uses a probability sampling model, with a total of 14 indicators. The number of samples is 140, The number of samples used is 5 to 10 times the number of indicators (31).

RESULT AND DISCUSSION

The analysis of the results of this study uses a multivariate statistical technique used to analyze the relationship between latent variables and indicators measured directly. SEM-PLS is particularly popular in the fields of social sciences, marketing, management, and education, due to its ability to handle data that does not meet the assumptions of normal distribution as well as small sample sizes. This study develops a structural model where digital_tools as a moderation variable. Model evaluation in PLS consists of evaluation of the measurement model (outer model); Structural model evaluation (inner model).

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue IV April 2025

Evaluation of the reflective measurement model (outer model)

The measurement model in this study consists of reflective measurements where the variables Hybrid_Educational , Student Engagement, digital_tools, and Academic Performance are measured reflectively. The evaluation of the measurement model consists of: loading factor (>0.60); composite reliability >0.70; Crombat's alpha and AVE(>=0.5), as well as the evaluation of the validity of discrimination, namely the fornell and lacker criteria and HTMT (heterotait monotrait ratio) below 0.90 and cross loading.

Table 1. Outer model analysis

variable	Measurement items	Indicators	Outer loading	Crombat's alpha	Composite reliability	AVE
	X6	Frequency of online learning	0.801			
Hybrid_Educational	X7	The degree of flexibility of time given to complete a task (asynchronous)	0.876	0.712	0.723	0.638
	X8	Live Virtual learning frequency (Synchronous)	0.711			
	M9	Frequency of use of LMS by students and teachers	0.820			
Digital_Tools	M10	Use of interactive apps for self-paced assignments or exercises	0.821			
	M11	The use of VR/AR in practicum or simulation learning	0.821	0.781	0.797	0.605
	M12	The frequency with which students participate in gamification-based activities.	0.659			
	YA14	actively participate in online group discussions or assignments	0.851			
Student Engagement (Keterlibatan Siswa)	YA15	feel more motivated to learn and complete tasks in a hybrid education model	0.820	0.802	0.808	0.716
	YA16	Hybrid education supports your engagement in learning	0.866			
	YB17	Hybrid model affects academic performance to the positive	0.796			
Academic Performance	YB18	Better academic outcomes with hybrid models	0.745	0.773	0.799	0.595
	Y19	hybrid education helps you understand the subject matter better	0.873			
	Y20	Hybrid Education Influences Exam and Evaluation Results	0.655			

Source: data processed (2024).

The Hybrid_Educational variable was measured with 3 valid indicators with the outer loading value ranging from 0.711 to 0.876. This shows that the three indicators are strongly correlated in explaining

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume X Issue IV April 2025

Hybrid_Educational. Among the three valid measurement indicators, the strongest is reflected by X7 (LF=0.877), namely the level of flexibility of the time given to complete the task (Asynchronous) and the weakest reflected by X8 (LF=0.711), namely: Direct Virtual learning frequency (Synchronous). Hybrid_Educational The reliability levels of Hybrid_Educational variables were acceptable with combat's alpha, composite reliability, and AVE values respectively: 0.712, 0.723, and 0.638.

The results of the research analysis show that hybrid learning can significantly improve student outcomes compared to traditional learning methods. A systematic review and meta-analysis highlighted that blended learning approaches often produce better performance metrics than purely online or traditional face-to-face learning environments (32). This is corroborated by the findings of a study of graduate-level public health courses, which reported that student exam performance and overall course outcomes were significantly higher in blended learning settings compared to traditional formats (33). The results show that the integration of online resources allows students to engage with the material at their own pace, thereby improving their understanding and retention of information (32).

In addition, the acceptance of the hybrid learning model among students is generally positive. A study examining learners' perceptions revealed that students favored the integration of e-learning tools in traditional classroom settings, indicating readiness for a hybrid educational framework (34). This acceptance is further supported by research showing that students equipped with the necessary technological tools and internet access show a preference for blended classes, as this environment facilitates greater engagement with the course material (35). The COVID-19 pandemic has accelerated this transition, as institutions have been forced to adopt a hybrid model, leading to increased familiarity and convenience with digital learning tools among students and faculty (36,37).

Next, the Student Engagement variable is measured with 3 valid indicators with outer loading values ranging from 0.820 to 0.866. This shows that the four idifiers are strongly correlated in explaining the Student Engagement variable. Among the three valid measurement indicators, the strongest is reflected by YA16 (LF=0.866), which is that hybrid education supports student engagement in learning. While the weakest is reflected by YA15 (LF=0.820), namely: feeling more motivated to learn and complete tasks in the hybrid education model. The reliability level of the Student Engagement variable was acceptable with combat's alpha, composite reliability, and AVE values respectively: 0.802, 0.808; and 0.716.

The same view is also expressed that student engagement is an important component of effective learning, especially in hybrid education settings. Research shows that hybrid learning environments require students to take more initiative and self-direction compared to traditional classroom settings (38). This is in line with Astin's theory of engagement, which argues that student engagement encompasses cognitive, behavioral, and affective dimensions, all of which are essential for successful learning outcomes (39). The findings from Jaya's study emphasize that active engagement in the face-to-face and online components is essential for creating meaningful learning experiences, reinforcing the idea that hybrid models should prioritize student engagement to improve academic achievement (40).

In addition to increasing engagement, the hybrid learning model also addresses various psychological aspects of learning. A study on self-compassion interventions in hybrid learning environments highlights the importance of emotional and social engagement, suggesting that hybrid models can reduce academic stress and increase motivation among students (41). This is in line with the idea that hybrid education not only provides academic benefits but also supports students' mental well-being, which is crucial in today's high-pressure education landscape.

Furthermore, the Academic Performance variable is measured with 4 valid indicators with outer loading values ranging from 0.655 to 0.873. This shows that the four idifiers are strongly correlated in explaining the Academic Performance variable. Among the four valid measurement indicators, Y1916 (LF=0.873) is the most strongly reflected in hybrid education helping you understand the subject matter better. While the weakest is reflected by Y20 (LF=0.655), namely: Hybrid education affects exam and evaluation results.

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Academic Performance The reliability levels of the Academic Performance variables can be accepted with combat's alpha, composite reliability, and AVE values respectively: 0.773, 0.799; and 0.595.

The results of this study are supported by previous research which states that the application of the hybrid learning model also requires careful consideration of pedagogical strategies. Effective hybrid education requires a blend of instructional methods that cater to different learning styles, such as visual, auditory, and kinesthetic approaches (42). By utilizing technology to create a more personalized learning experience, educators can improve student engagement and performance, ultimately leading to improved educational outcomes (43,44).

Based on Table 1 and the description above, it can be concluded. Indicator Validity: most indicators have an outer loading ≥ 0.7, indicating good indicator validity. Indicators with a load between 0.5–0.7 (such as M12, Y20) are still acceptable for exploratory research, but their contribution is lower. Furthermore, Construct Reliability: which is reflected from Cronbach's alpha value and composite reliability for all constructs meets the criteria ≥ 0.7, indicating adequate internal consistency. Then Convergent Validity: All constructs have an AVE ≥ 0.5, indicating that the indicators substantially reflect the latent construct.Potential Improvements: Indicators with low outer loading (e.g., M12 and Y20) may be fixed or considered for removal if they are not relevant to the construct.

Evaluation of the structural model (inner model)

Multicolonials between latent variables

In the evaluation of the structural model (inner model) using SEM-PLS, **Variance Inflation Factor (VIF)** is used to detect the existence of **multicollinearity** between latent independent variables. Multicollinearity occurs when independent variables have a high correlation, which can reduce the accuracy and interpretation of structural models.

According to (31), the general rules for VIF are:

- **VIF < 5**: No serious multicollinearity, the model can be interpreted validly.
- **VIF ≥ 5**: Demonstrates significant multicollinearity and requires special attention.

The results of the Multicoloniality test between the latent variables, are shown in Table 2.

Table 2. Multicollineary Test Results between Latent Variables

	VIF
Digital_tools →Academic_Performent	1.502
Digital_tools →Student Engagement	1.502
Hybrid_Educational →Academic Performance	1.434
Hybrid_Educational →Student Engagement	1.434
Digital_tools X Hybrid_Educational →Academic Performance	1.082
Digital_tools X Hybrid_Educational → Student Engagement	1.082

Source: processed data (2024).

Based on the results of the analysis as shown in Table 2. Declares that All VIF values are below 5, which means:

1. There are no serious multicollinearity problems in the relationship between latent variables.
2. The relationship between independent variables (Digital Tools and Hybrid Educational Models) and dependent variables (Academic Performance and Student Engagement) can be interpreted validly.

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3. The interaction between Digital Tools and Hybrid Educational Models makes an independent contribution in predicting dependent variables.

Thus, the results of the inner model analysis, such as path coefficients and determination coefficients (R^2 and Q^2), can be relied upon to evaluate the research hypothesis.

Research Hypothesis Test

This study examines the influence of Hybrid Educational Models and Digital Tools on Academic Performance and Student Engagement, and evaluates the interaction between the two. The results of the analysis show a clear difference between significant and insignificant hypotheses, which provides important insights for developing a hybrid education model in the digital era. The results of the hypothesis test are shown in Table 3.

Table 3. Results of Hypothesis Test.

Hypothesis	Hypothesis Statement	Path coeficients	P-Valae	95% path coeficient confidence interval		F-Square
				Lower limit	Upper limit	
H1	Digital_tools →Academic_Performent	0.271	0.000	0.271	0.276	0.107
H2	Digital_tools →Student Engagement	0.192	0.018	0.192	0.195	0.052
H3	Hybrid_Educational →Academic Performance	0.550	0.000	0.550	0.552	0.462
H4	Hybrid_Educational →Student Engagement	0.582	0.000	0.582	0.584	0.496
H5	Digital_tools X Hybrid_Educational →Academic Performance	-0.009	0.856	-0.009	-0.017	0.000
H6	Digital_tools X Hybrid_Educational → Student Engagement	-0.041	0.418	-0.041	-0.034	0.008

Source : processed data (2024)

Based on the results of the hypothesis test as shown in Table 3. shows that there are significant and insignificant relationships between latent variables,

Significant Hypothesis

H1: Digital Tools → Academic Performance

Path coefficient of 0.271 and **p=0.000**, shows a significant positive relationship between the use of digital tools (e.g., Learning Management Systems, interactive applications, or VR/AR) on academic performance. The effect was small (**f2=0.107),** but the confidence interval that did not cross zero strengthened the validity of this result. These findings are in line with previous research showing that digital tools improve the accessibility of learning materials and accelerate student understanding (5).

H2: Digital Tools → Student Engagement

A path coefficient of 0.192 (**p=0.018)** also showed a significant relationship, although the effect was small (f2=0.052). Digital tools have been proven to increase student engagement, especially in gamification-based activities or online discussions. Other research supports that the use of interactive digital tools can motivate students to be more involved in the learning process (20).

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H3: Hybrid Educational Models → Academic Performance

A path coefficient of 0.550 (**p=0.000)** showed a very significant positive relationship with a large effect (f2=0.462). Hybrid Educational Models, which combine synchronous (virtual face-to-face) and asynchronous learning, help improve students' academic performance by providing flexibility and personalization of learning. These results support the findings of (19), which shows that the hybrid model facilitates the mastery of matter more effectively.

H4: Hybrid Educational Models → Student Engagement

The path coefficient of 0.582 (**p=0.000) with a large effect (f2=0.496)** shows that the hybrid education model has a very strong influence on student engagement. The flexibility and combination of face-to-face and online learning allows students to be more involved in group discussions and collaborative activities. Research by (24) also shows that hybrid learning supports students' active participation in digital learning environments.

Insignificant Hypothesis

H5: Interaction of Digital Tools x Hybrid Educational Models → Academic Performance

A path coefficient of -0.009 (p=0.856) indicates a very weak and insignificant negative relationship. The moderation effect of the interaction between Digital Tools and Hybrid Educational Models on Academic Performance was almost non-existent (**f2=0.000),** and the confidence interval that crossed zero corroborated this result. This shows that although these two factors are significant individually, the moderation effect does not contribute strongly to the two variables, namely the Educational Models on Academic Performance.

H6: Digital Interaction Tools x Hybrid Educational Models → Student Engagement

Similar results were found for interactions with Student Engagement, with a path coefficient of -0.041 (**p=0.418**) and a near-non-existent size effect (f2=0.008). Confidence intervals that crossed zero showed that the interaction between these two factors was not significant in increasing student engagement.

From the description of the results of the hypothesis test above, it can be concluded that

H1, H2, H3, H4 accepted:

a. **Hybrid Educational Models** have a stronger influence than Digital Tools on Academic Performance and Student Engagement. This shows that the combination of online and face-to-face learning has a greater positive impact than digital tools used separately.
b. Digital Tools continue to make a significant contribution to student engagement and academic performance, albeit with a smaller effect.

H5 and H6 are rejected:

a. The interaction between Digital Tools and Hybrid Educational Models did not make any significant additional contributions, suggesting that the effects of the two were independent.

This research makes an important contribution in understanding how digital technologies and hybrid education models can be integrated to improve the student learning experience. These findings support previous literature highlighting the importance of flexibility and personalization in modern learning(5,19,20).

CONCLUSION

The research aims to explore the effectiveness of the hybrid education model in improving student engagement and academic performance, as well as the role of digital tools in supporting this model. The

results show that the hybrid education model has a significant and strong influence on student engagement and academic performance, compared to the independent use of digital tools. However, the interaction between digital tools and hybrid education models did not make a significant additional contribution to both variables.

This research emphasizes the importance of flexibility and personalization in modern learning, supporting the transformation of education in the digital era.

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