A Rapid Review of Literacy and Artificial Intelligence: The Future of Blended Learning

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Abstract. With the rapid development of artificial intelligence (AI) technology, the scope of digital literacy has evolved beyond mere computer operating skills to include the understanding and application of AI. Although the importance of AI and digital literacy in educational settings is widely recognized, there remains a notable research gap on how to effectively integrate AI into education, especially blended learning, and on how to foster digital literacy associated with it. This study employed keyword searches to review 86 articles on digital literacy and AI from 2020 to 2024 in Web of Science. From these, 29 were selected for quality assessment and detailed analysis based on their discussion of this relationship. The findings indicate an annual increase in publications related to AI and digital literacy, showing diverse country distribution, research methods and broad topics. Moreover, a theme analysis indicates "AI", "Digital Literacy", "Education", "ChatGPT", "Algorithmic Literacy", "Blended Learning", "Generative AI". This paper provides insights for educators, administrators, and researchers in the fields of educational technology and curriculum development.

Keywords: Artificial Intelligence, Digital Literacy, Blended Learning, Higher Education

1 Introduction

With the rapid development of artificial intelligence (AI) technology, the concept of digital literacy expanded from traditional computer operation skills to include AI. As AI technology has been involved in various fields such as education, healthcare, and business, it not only changes work practices but also raises the demands on personal digital literacy [1][2].

However, despite the great potential of AI technology, how to effectively integrate AI into education and daily life, and how to foster digital literacy associated with it, remains a major challenge for both academia and the public. The relationship between AI usage and digital literacy is currently studied in a fragmented manner without systematic integration or comprehensive analysis. Specifically, in education,

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significant questions remain about how to develop and enhance students' AI and digital literacy skills and how to assess and improve these capabilities effectively [3][4].

Additionally, the application of AI in organizational contexts and its impact on employee performance is emerging as a new area of research interest [5]. Although the significance of AI and digital literacy in higher education is widely acknowledged, there is still limited research on how these elements can be effectively integrated into blended learning models and what their long-term impacts might be.

The convergence of AI, digital literacy, and blended learning within higher education is prompting a major shift in educational models. This shift is not only providing a more personalized and flexible learning experience for students but also introducing new teaching challenges and opportunities. The studies cited offer new insights into the role of AI in education, particularly in the design and implementation of intelligent learning systems [6]. Furthermore, the exploration of digital literacy has deepened our understanding of how educational technologies can be integrated, highlighting the critical importance of nurturing students' abilities to think critically and learn independently [7].

To address these gaps, this study conducts a systematic literature review to examine the relationship between AI use and digital literacy, assessing the impact of AI technologies across various sectors on individual digital literacy levels. Our approach involved searching the Web of Science (WoS) database for authoritative sources from fields including education, information science, psychology, and business management. By meticulously searching, screening, and analyzing relevant literature, the study aims to construct a theoretical framework that elucidates how AI influences digital literacy. This rapid review seeks to provide educators, policymakers, and technology developers with insights necessary to understand and enhance digital literacy, thereby enabling better integration of AI technologies in diverse professional and educational contexts.

2 Literature Review

2.1 Artificial Intelligence

AI is a rapidly growing field that combines machine and human intelligence to provide a variety of applications, including expert systems, neural networks, robotics, natural language processing, face recognition, and speech recognition [8]. AI aims to mimic human intelligence in computers and improve the performance of manufacturing, service systems, and expert systems in science, engineering, business, medicine, and weather forecasting [9]. The field has seen a remarkable growth in research activity over the years, with an eight-fold increase in AI -related publications on Scopus since 1996 [10]. Despite its relative infancy as a science, AI shows promise for the future, with increasing research focusing on improving all aspects of life through innovative technological solutions [11].

In the field of higher education, AI has been identified as having substantial potential, particularly in areas of personalized learning, assessment, and the overall enhancement of educational quality [6][7]. Studies have shown that AI-driven personalized learning systems improve academic performance and student satisfaction [12].

2.2 Digital Literacy

Digital literacy is an essential set of skills that equips individuals to thrive in the digital age. It encompasses the ability to access, understand, and create digital content, as well as to communicate and share information using digital technologies [13]. Digital literacy is widely recognized as an essential competency in higher education, which includes not only the understanding and application of technology, but also the critical thinking and ethical use of information [6][7]. This skill set combines technical knowledge with critical soft skills such as information management, collaboration, digital content creation, cybersecurity awareness, and problem-solving [14].

In educational settings, digital literacy is recognized as a crucial life skill. It involves using digital tools to enhance learning processes, from researching and verifying information to creating digital projects and communicating effectively on digital platforms [13]. Beyond mere technical proficiency, digital literacy in schools encourages critical thinking, problem-solving, and adaptability to the ever-evolving digital landscape [15]. Teachers need digital literacy to plan and do lessons that use technology, and students need it to fit into a learning place that's full of digital stuff [16]. Consequently, digital literacy is vital not only for lifelong learning but also for maintaining flexibility in today's dynamic job market [17].

Moreover, the recent introduction of algorithmic literacy, as discussed by Ridley and Pawlick-Potts [4], highlights the evolving nature of digital literacy, emphasizing the need for an understanding of AI technologies and the ability to critically evaluate and apply them responsibly. Ridley and Pawlick-Potts [4] emphasize the role of algorithmic literacy in filling in the gaps in the current digital literacy or information literacy system [4]. They believe that in order to use AI responsibly, it is necessary to increase public awareness and understanding of algorithms.

2.3 Blended Learning and AI

Blended learning combines traditional face-to-face teaching with modern e-learning technologies to create a flexible, timely, and continuous learning experience [6]. This educational approach allows students to engage with structured content, such as online lectures, assignments, discussions, tests, and exams, in various forms, including blended, hybrid, flipped, or inverted formats.

In a blended learning model, course content is logically segmented, and each segment concludes with a question that students must answer in natural language within the system. The blended learning model enables students to learn flexibly according to their progress and personal learning paths, considering their individual

learning abilities and rates, irrespective of time and place. This model aims to improve the quality and effectiveness of education by combining online and offline elements, providing a personalized learning experience.

Blended learning's application in physics education exemplifies its potential to offer personalized learning opportunities, optimizing the quality of learning in physical education courses and motivating students [18]. Through scientifically planned and rationalized teaching and learning processes, students can align their learning characteristics with the teaching style of educators.

2.4 Integration of AI in Education

Recent studies have highlighted the transformative potential of AI across various educational levels, from early childhood education to higher education, emphasizing its capacity to enhance digital literacy and transform teaching methodologies. Yang et al.[18] demonstrated the integration of AI in early childhood education through embodied learning activities supported by intelligent agents, allowing young children to grasp AI basics. This application shows AI's potential to bolster digital literacy from an early educational stage.

In the context of specialized education, Schwendicke[19] explored the use of AI in dental education, noting its effectiveness in streamlining dental care processes and enhancing service quality through personalized, predictive, preventive, and participatory approaches. However, they also highlighted challenges such as data availability and methodological rigor, which are critical in optimizing the use of AI in such specialized fields.

Further expanding on the impact of AI in higher education, Walczak and Cellary [20] observed a paradigm shift in teaching methods and the role of educators driven by Generative AI. They emphasized the importance of fostering digital literacy and ethical considerations in using AI technology. Complementing these findings, Hwang et al.[2] developed a digital literacy scale to assess college students' perceptions of AI technology, discovering that the ability to use AI technology strongly predicts its perceived usefulness and ease of use, which underscores the necessity to enhance digital literacy in higher education.

Additionally, the integration of AI in education presents various challenges and risks. For instance, Walczak [20] discuss the practical issues surrounding the value and usefulness of AI solutions in dentistry, emphasizing the need to address ethical and accountability concerns. Similarly, Chan and Lee [21] found that while Gen Z students are generally optimistic about the potential benefits of generative AI, older generations of teachers express concerns regarding over-reliance and the ethical implications of AI in teaching.

3 Method

This study adopted a rapid review method, which is “a type of knowledge synthesis in which components of the systematic review process are simplified or omitted to

produce information in a short period of time" [22]. This method provided a prompt synthesis and summary of the key insights from recently published articles [23]. According to Watt[24], "the essential conclusions of the rapid and full reviews did not differ extensively across topics", even though the rapid review used less rigorous standard than those typical of a traditional systematic review [23]. Following the rapid review protocol recommended by Speckemeier [25], we collected and screened relevant literature. We then carefully evaluated and synthesized the findings, which are described in detail below.

3.1 Literature Search

We started our literature review by conducting a keyword search in the WoS database, using "digital literacy" and "AI" as search terms. This search generated a total of 133 articles that mentioned both terms in their abstracts. This step is essential to begin a thorough coverage of resources for the literature review [26][27].

3.2 Literature Screening

From the initial collection, we further screened out the literature with a time range between 2020 and 2024, resulting in 86 articles. This specific time frame was chosen to ensure that our research is grounded in the most current data and reflects the latest developments and trends digital literacy and AI [28].

3.3 Content Screening

From the identified 86 articles, we conducted an in-depth content review to identify those specifically addressing both "digital literacy" and "AI." Articles focusing solely on one of these areas were excluded from further analysis. After this rigorous screening process, we retained 29 articles that offered comprehensive discussions on both digital literacy and AI This selection process aligns with research standards established by Whiting [26].

3.4 Literature Evaluation

The remaining 29 articles were evaluated for their quality, focusing on their research design, data collection and analysis methods, the reliability of their findings, and their contribution to the existing body of knowledge. In the evaluation process, special attention was paid to the innovation of the literature, the depth of the research, and the author's research perspective [29].

3.5 Comprehensive Analysis

On the basis of the evaluation, we conducted a comprehensive analysis of these 29 articles. During the analysis, we identified the main themes, theoretical frameworks,

research methods and important findings that emerged from the research. This analysis also allowed us to explore how these studies contribute to our understanding of digital literacy and AI. Additionally, we identified gaps in the existing research and suggested potential directions for future studies, particularly in the context of blended learning. These procedures enable researchers to contribute to a research gap and advance the field [30].

3.6 Research Questions

Ultimately, this systematic review research focuses on the following major research questions as follows:

Research question 1: What is the yearly distribution of articles related to digital literacy and AI?

Research question 2: What is the country distribution of articles related to digital literacy and AI?

Research question 3: What research methods are employed in articles related to digital literacy and AI?

Research question 4: What are the dominant key themes of articles related to digital literacy and AI?

Research question 5: What will the future hold for blended learning as digital literacy increases in AI-style education?

4 Results

4.1 Yearly Distribution of Articles Related to Digital Literacy and AI

Figure 1 shows that the number of articles published on the WoS has been increasing steadily over the past five years. In 2020, there were 2 articles published, followed by 3 articles in 2021. The publication rate increased to 6 articles in 2022 and doubled to 12 articles in 2023. So far in 2024, 16 articles have been published, continuing the pattern of growth.

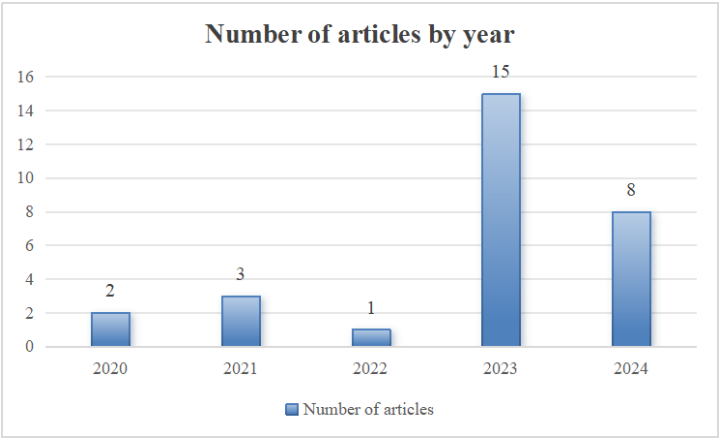

Fig. 1. Number of articles by year

4.2 Country Distribution of Articles Related to Digital Literacy and AI

Figure 2 provides a comparative overview of the number of articles published by various countries in the field of study. The chart is titled "Number of articles," which indicates the count of published articles. The x-axis categorizes the countries, and the y-axis quantifies the number of articles each country has published.

As shown in Figure 4, the highest number of articles, 10, were published from an unspecified region marked "not mention." America contributed four publications, making it one of the most prolific contributors. Taking third place with three publications is China. Other nations like India, Kazakhstan, Germany, Japan, Australia, Poland, Romania, America, Korea, and Malaysia each contributed 1 or 2 articles.

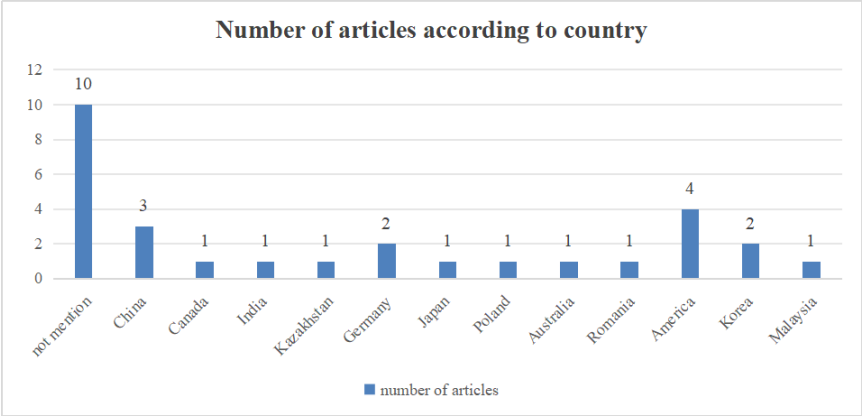

Fig. 2. Number of articles according to country

4.3 Research Methods Employed in Articles Related to Digital Literacy and AI

Figure 3 illustrates the distribution of articles across different research methodologies. The "Quantitative" category leads with the highest number of articles, totaling 10. This is closely followed by the "Qualitative" category, which has 17 articles. The category combining both methodologies, labeled "Both," has the fewest articles, with only 2 articles produced.

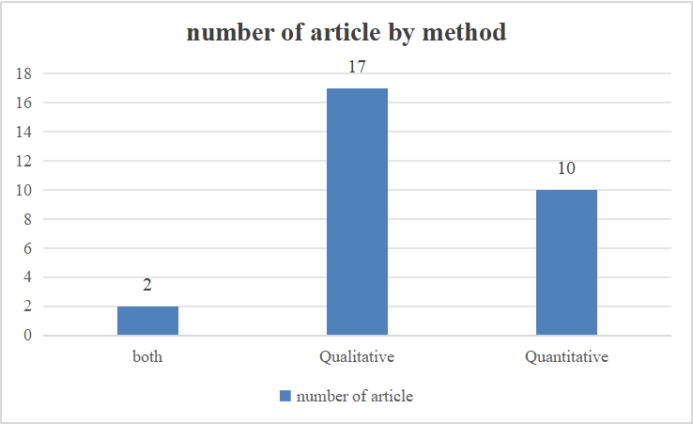

Fig. 3. Types of articles

4.4 Dominant of Key Themes of Articles Related to Digital Literacy and AI

We adopted word occurrence frequency analysis[10] to analyze the high-frequency words in the abstracts of 29 selected articles, and the analysis results are presented in figure 4.

The keyword “AI” emerged as the most frequent, appearing 11 times across 9 different articles. “Digital Literacy” and “Education” are tied for the second most frequent keywords, each appearing seven times in 7 articles. The specific AI tool, “ChatGPT, ” was mentioned 5 times in 4 articles. The term "Higher Education" also appeared 5 times in 5 articles. Finally, the three keywords “Algorithmic Literacy,” “Blended Learning” and “Generative AI” each appeared 3 times, involving 2, 3 and 3 articles, respectively.

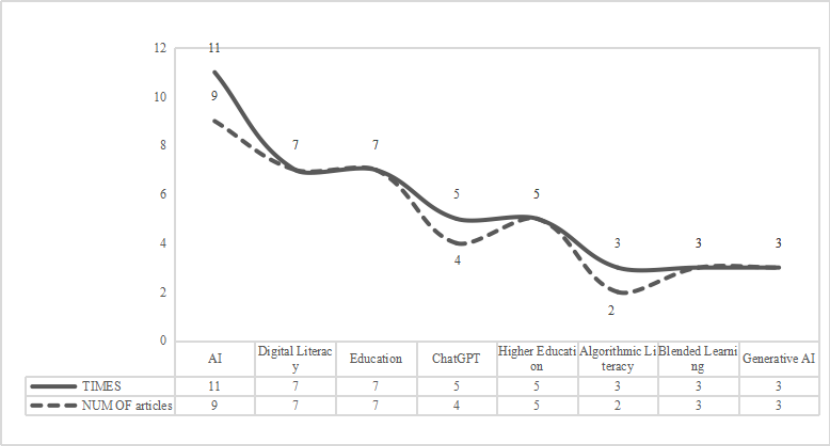

Fig. 4. Key themes of digital literacy and AI-related articles

4.5 The Increasing Role of Digital Literacy in AI-Blended Learning

Among the 29 reviewed literatures, six emphasize that AI facilitates personalized learning by leveraging intelligent tutoring systems, adaptive assessments, and instant feedback to meet diverse learner needs [3][6][7][21][31][32]. Furthermore, these studies highlight the importance of cultivating digital literacy as essential for enhancing students' comprehensive abilities and preparing them for future job markets.

Specifically, Bekmanova et al.[6] proposed a personalized training model for organizing blended learning and lifelong distance learning courses, emphasizing the importance of digital skills for personalized learning in higher education. Grosseck [7] analyzed how higher education teachers in Romania assess their own digital competencies and how they use digital assessment tools. They highlighted the main issues, challenges, and obstacles teachers encounter when designing and using digital assessments.

Chan & Lee [21] explored the experiences, perspectives, knowledge, concerns, and intentions of Generation Z students and Generation X and Y teachers in using Generative AI (GenAI) in higher education. They particularly emphasized the importance of cultivating digital literacy and critical thinking skills for the responsible use of GenAI technology.

Johinke [32] stated that A new wave of digital writing technologies has emerged: AI-powered writing generators like ChatGPT have arrived, poised to transform and expand the scope of digital literacy. This emerging technology indicates the necessity of integrating digital literacy into the curriculum, particularly gaining opportunities to improve instructional strategies and approaches in blended learning, to ensure students are equipped to use these tools effectively and responsibly.

5 Discussion

We analyze 29 articles from the WoS published from 2020 until 2024 related to digital literacy using a systematic review. The initial results suggest that the volume increased over time that is from 2020 to 2024. This trend indicates an awareness of the importance of AI and digital skills in contemporary education, and is in line with the view of Erokhin [10] about a high growth of articles about AI. Country contributions further showed that AI and digital literacy research are of interest across a wide variety of geographical locations. In addition, the majority of articles using qualitative research techniques.

The word occurrence frequency analysis of the 29 selected articles reveals several dominant themes in digital literacy and AI. “AI” emerged as the most frequent keyword, appearing 11 times across 9 articles, underscoring its central role in educational technology research and its significant potential in personalized learning and assessment [6][7]. The terms "Digital Literacy" and “Education’ each appeared seven times, highlighting the critical importance of digital literacy in equipping individuals with essential skills for the digital age [14]. Additionally, "Higher Education" appeared 5 times, reflecting active research efforts to integrate AI and digital literacy to innovate and improve practices at this educational level [20].

The frequent mention of “ChatGPT” (5 times in 4 articles) indicates growing interest in AI tools' educational applications, aligning with broader trends exploring their utility in enhancing learning experiences [33]. Keywords such as “Algorithmic Literacy,” “Blended Learning,” and “Generative AI,” each appearing 3 times, point to emerging areas of interest. The emphasis on algorithmic literacy underscores the need for understanding and responsibly using algorithms, filling gaps in current digital literacy frameworks[14]. Blended learning and generative AI represent innovative teaching methods that combine the flexibility of online education with traditional approaches, thereby enhancing personalized learning opportunities [6][21].

The literature consistently highlights the transformative potential of AI and digital literacy in education, particularly within the framework of blended learning. It highlights how AI facilitates personalized learning through intelligent tutoring systems, adaptive assessments, and instant feedback to address diverse learner needs [3][7]. This is particularly evident in the increasing application of AI across all educational levels, from early childhood [18] to higher education, demonstrating AI's capacity to enhance digital literacy and transform educational practices.

Emerging technologies such as AI-powered writing generators, like ChatGPT, are expanding the scope of digital literacy, emphasizing the need to integrate digital literacy into blended learning curricula to improve instructional effectiveness and ensure responsible usage [32]. In practical terms, it is suggested that nursing educators incorporate tools like ChatGPT into their curricula through formative or summative assessments, emphasizing the importance of teacher development to effectively understand and utilize AI technologies [33].

Furthermore, the application of AI in higher education is progressively altering traditional teaching and learning models. AI chatbots, such as ChatGPT, are increasingly used to facilitate interactive learning, self-assessment, and personalized

learning paths, illustrating a shift towards more dynamic educational methods [31][32]. As these technologies are integrated, there is a clear signal for teachers to update their implementation strategies within blended learning models. This involves integrating AI tools and fostering students' digital literacy to accommodate various learning styles and needs [7][32]. This shift suggests a need for educators to carefully select and deploy AI tools that align with teaching objectives and enhance learning outcomes. Curriculum design, particularly for blended learning courses, must also evolve to include digital literacy development, preparing students to thrive in a digital learning environment and equipping them for future careers.

6 Conclusion and Implication

This study provides a comprehensive analysis of the dominant themes related to digital literacy and AI in education, based on a word occurrence frequency analysis of 29 selected articles. The findings emphasize the central role of AI in contemporary educational technology research, highlighting its significant potential in personalized learning and assessment. The recurring themes of "Digital Literacy" and "Education" emphasize the critical importance of equipping individuals with the necessary skills to thrive in the digital age, while the frequent mention of "ChatGPT" and other AI tools reflects the growing interest in their educational applications.

The study also highlights emerging areas of interest such as algorithmic literacy, blended learning, and generative AI, which represent innovative approaches to teaching and learning. These findings align with existing literature that emphasizes the transformative potential of AI and digital literacy in enhancing educational outcomes across all levels, from early childhood to higher education.

Existing research exploring AI and digital literacy may not adequately consider the impact of the pace of technological change on educational practice, as well as adaptability and effects across disciplines and teaching Settings [7]. Research on the long-term effects of blended learning models and their effects on students' learning behavior is still insufficient [6].

Therefore, future research should explore the adaptability and acceptability of AI in different educational settings and how AI tools can be tailored to the needs of different disciplines [18]. More in-depth research on digital literacy development strategies is needed to ensure that all students benefit from technology integration [32]. The long-term effect of blended learning model and its influence on students' learning behavior are also important directions for future research.

Moreover, future research should consider the primary trends in qualitative studies, clearly indicating a need for more research oriented towards quantitative approaches. Although this requires more effort and time, mixed-methods research would contribute to a comprehensive understanding of digital literacy. As digital literacy encompasses a broad range of technologies, it necessitates designing specific case studies, such as digital literacy pertaining to artificial intelligence or drone usage. Digital literacy impacts various aspects of human life, including education, business, health, and governance. Therefore, distinct case studies can be developed for each

unique dimension of life. For instance, it is particularly worth investigating the role of digital literacy in lifelong learning, its overall impact on education, and how enhancing digital skills affects labor market flexibility. Further experimental research is needed to understand how certain variables (such as age, gender, socioeconomic status, cognitive abilities, etc.) explicitly or implicitly influence this concept. Additionally, the digital divide issue needs to be analyzed from the perspective of its main determinants.

In practice, educators and administrators must recognize that digital literacy encompasses multiple dimensions and variables during its implementation. Stakeholders need to deepen their understanding of the beneficiaries or participants to enhance the effectiveness of digital literacy-related activities. As digital literacy is influenced by critical thinking and problem-solving skills, it is crucial to assess these skills among participants initially. Developing digital literacy across different groups may require tailored strategies, as each group could have distinct skillsets, capabilities, or qualities. Collaboration among experts from various disciplines, including technology specialists, instructional designers, and content experts, is essential[33]. Adaptable digital frameworks for different technologies and backgrounds should be developed and regularly updated in response to the fast-evolving digital landscape. Annual reviews of technological trends are recommended to determine necessary updates to these frameworks.

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Appendix: List of papers (n=29) included in the qualitative analysis-ordered alphabetically by title

Abou Hashish, E. A., & Alnajjar, H. (2024). Digital proficiency: assessing knowledge, attitudes, and skills in digital transformation, health literacy, and artificial intelligence among university nursing students. *BMC Medical Education*, *24*(1), 508.
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