

AI-Driven Augmented Reality Learning Based on Big Data in Islamic History Education: A Transformation Model from Conventional to Visual-Immersive Approaches

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ABSTRACT

History teaching in Islamic Education remains dominated by conventional lecture-based approaches that position students as passive recipients of information. This approach reduces learning engagement, limits historical imagination, and does not align with the characteristics of the digital generation, who are accustomed to interactive and visual learning experiences. This study employs a conceptual qualitative approach using a literature review design and theoretical analysis grounded in constructivism, multimedia learning, and experiential learning. Data were collected from books and scholarly articles on Artificial Intelligence (AI), Augmented Reality (AR), Big Data, and digital transformation in education, then analyzed thematically to develop an integrative conceptual model. The findings indicate that AI enables personalized learning through learning analytics, AR provides immersive visualization of historical events, and Big Data supports evidence-based instructional decision-making. These technologies collectively form an AI-Driven Augmented Reality Learning model based on Big Data that transforms history education from a textual and narrative approach into a visual, immersive, adaptive, interactive, and contextual learning experience. The proposed model also redefines teachers as facilitators and designers of technology-enhanced learning while emphasizing the importance of adequate digital infrastructure and digital literacy to ensure effective implementation in Islamic Education.

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1. INTRODUCTION

Effective student learning emphasizes interactive approaches through small group discussions and evidence-based teaching that stimulate critical thinking and deep understanding by considering student diversity and the use of technology (Fry dkk., 2009, hlm. 310–311). Successful teaching methods include the use of analogy, storytelling, and hands-on practice to make material more relevant and memorable, so that students not only memorize but also internalize knowledge through active experience (Nilson, 2010, hlm. 181). Effective holistic education integrates comprehensive development, as well as emotional and social aspects, enabling students to gain not just facts but also critical thinking skills and the ability to adapt in the real world (De Florio, 2016, hlm. 34–35). Therefore, a good learning model should encourage active student engagement through visual and immersive elements, avoiding passive delivery that tends to cause boredom.

Nevertheless, the process of teaching history in schools generally remains static and conventional. Static here means that history teachers do not make changes over time and only use conventional methods such as lectures, merely reading aloud or repeating sentences from the book, while students only experience learning by listening, taking notes, and memorizing material delivered by the teacher (Muis dkk., 2023, hlm. 13484). Findings by Akhmad Syaekhu Rakhman in grade X at Budhi Warman I High School show that one of the problems regarding student interest in learning history is that educators still use conventional teaching methods, where instruction remains teacher-centered. The teacher explains lesson material in front of the class so that students become sleepy and bored with History lessons, resulting in low interest in attending History classes (Rakhman dkk., 2025, hlm. 85). Subakti's research, as cited by Bahtiar Afwan, also reveals that there are many issues faced by history education today, including weak use of theory, a lack of imagination, reliance on state-oriented textbooks and curricula, low motivation and interest among students, and a tendency to disregard globalization phenomena and their historical backgrounds.

Considering the ongoing problems related to students' interest above, this is an important issue to be investigated and solved. The paradigm of conventional learning with the same methods and media needs to be changed to innovative history teaching aligned with today's digital era (Afwan dkk., 2020, hlm. 98). The use of instructional media is essentially aimed at conveying messages, stimulating thought, feeling, and attention, raising students' enthusiasm and interest, thereby making the learning process more effective and efficient (Suryani, Nunuk, 2018, hlm. 5). Interactive multimedia is considered a relevant instructional medium in the current context. In addition, interactive multimedia is useful for improving student learning outcomes. Interactive multimedia allows students to interact with the medium, making learning more engaging. Interactive multimedia is a combination of various media such as video, audio, photos, graphics,

animation, and text, packaged in an integrated and interactive manner. Effective learning can be enhanced if teachers can combine visual, auditory, and kinesthetic learning styles (Silberman, Melvin L, 2019, hlm. 28). Research shows that students' imagination in learning history can be improved with the use of multimedia. Through imagination, students gain meaningful learning in line with the objectives of history education (Supriatna, 2019, hlm. 81–82).

Based on studies on the issues and innovations in teaching the above-mentioned history material, the researcher proposes a solution by integrating AI, AR (Augmented Reality), and big data into the teaching of Islamic history. Systematic research on AR in Islamic Education indicates that AR increases motivation, engagement, and understanding of religious concepts, but has not yet explicitly integrated AI or big data, nor has it focused on visually immersive history learning as a curriculum transformation model (Ajmain dkk., 2025). Another SLR on AR/VR and learning analytics in education found that learning trajectory analysis (big data) can enhance performance and learning experience, but these studies generally occur in general contexts (K-12, higher education) and are not specific to Islamic Education or religious history (Sakr & Abdullah, 2024). Comprehensive reviews of AR in education show that AR is effective in improving engagement, motivation, and learning experience; however, the focus is on a generic AR framework (toolkit, 3D models, mobile AR) without deep integration with adaptive AI or the context of Islamic values (Garg dkk., 2025; Koumpouros, 2024). On the other hand, studies on AI and big data in education emphasize major trends in assessment, personalized learning, and precision education, but do not address how AI and big data are combined with AR to transform history learning into a visual-immersive experience (Luan dkk., 2020). Finally, research on technology integration in Islamic Education shows positive acceptance of AI and digitalization, but remains at the level of general technology use (platforms, media), so the combination of immersive AR + adaptive AI + big data learning analytics specifically for Islamic Education history is a gap that can be filled by the proposed model, while also distinguishing it from previous research (Priyono dkk., 2025; Siregar dkk., 2025).

The urgency of this research stems from the fact that the teaching of Islamic Cultural History (ISHC) is still dominated by conventional approaches oriented towards lectures, memorization, and textual delivery of material, so that students tend to be passive recipients of information. This condition results in low learning engagement, limited critical thinking skills, and underdevelopment of students' historical imagination in understanding Islamic historical events contextually. On the other hand, the development of digital technology has given rise to a generation characterized by visual, interactive, adaptive, and experience-based learning. Although various studies have discussed the use of Artificial Intelligence (AI), Augmented Reality (AR), and

Big Data in education, studies that comprehensively integrate these three technologies to transform the teaching of Islamic Cultural History are still very limited. This gap makes this research crucial as an effort to develop a learning model capable of addressing the challenges of transforming Islamic education in the digital era. Therefore, this study aims to analyze the characteristics and weaknesses of Islamic Cultural History learning that still uses conventional approaches. It also examines the potential integration of Artificial Intelligence (AI), Augmented Reality (AR), and Big Data to improve learning quality. It also formulates a conceptual model for AI-Driven Augmented Reality Learning Based on Big Data that can transform Islamic History learning from a textual-narrative approach to visual, immersive, adaptive, interactive, and data-driven learning.

The novelty of this research lies in the development of a conceptual model that integrates Artificial Intelligence (AI) as a personalized adaptive learning system, Augmented Reality (AR) as a visual-immersive medium for contextually reconstructing Islamic historical events, and Big Data as the basis for learning analytics for evidence-based learning decision-making, into a unified learning ecosystem. Unlike previous research, which generally utilizes only one technology or examines it within a general educational context, this study offers a new synthesis specifically designed for Islamic Cultural History learning by integrating constructivist theory, multimedia learning, and experiential learning. The resulting model not only produces innovative learning media, but also transforms the role of teachers into facilitators, learning designers, and learning data analysts, thereby creating Islamic history learning that is more personal, contextual, evidence-based, and relevant to the needs of 21st-century students.

2. METHODS

This study uses a qualitative research design based on a literature review with a narrative-synthetic approach to systematically analyze scholarly works on the integration of AR, AI, and Big Data in the teaching of Islamic history. This design was chosen because it enables critical review and synthesis of both conceptual and empirical studies without direct fieldwork, as recommended by Creswell & Poth (2016) and Snyder (2019) (Creswell & Poth, 2023; Snyder, 2019).

Data sources were obtained through a systematic literature review of books, reputable journal articles, and research reports related to AI in education, augmented reality learning, big data analytics, and history pedagogy. The collected data were thematically analyzed to identify gaps between conventional teaching approaches and the visual-immersive learning needs of the digital generation. To ensure novelty and relevance, inclusion criteria were focused on research published within the last five years, with essential references included as theoretical foundations. Selected works must address AR-based learning media, its application in Islamic history or religious education, as well as results related to technology, pedagogy, or content dimensions.

Data analysis was conducted in three stages of narrative synthesis. First, studies were identified and categorized based on their contribution to the integration of AR in education. Second, recurring themes were synthesized, particularly regarding media development, feasibility validation, user responses, and effectiveness in increasing understanding and engagement. Third, Artificial Intelligence was positioned as an adaptive system for content personalization, Augmented Reality as a visual-immersive medium, and Big Data as an analytical basis for evidence-based instructional decision-making (Thomas & Harden, 2008). The design process was carried out iteratively by mapping the relationships among technology components and pedagogical principles within a unified systemic framework.

The conceptual validity of the model was strengthened through theory triangulation by comparing various academic perspectives on digital transformation in education. The analysis was also conducted using an integrative approach to ensure alignment between theological, historical, and pedagogical aspects in the context of Islamic Education. The resulting model was then set out in a conceptual diagram illustrating the integration flow of AI-Driven AR based on Big Data in history teaching. Model evaluation was performed argumentatively through internal coherence tests, theoretical consistency, and contextual relevance to the character of the digital generation. The final result of this research is a prototype model for transforming Islamic history teaching from a conventional approach to a visual-immersive approach based on intelligent technology.

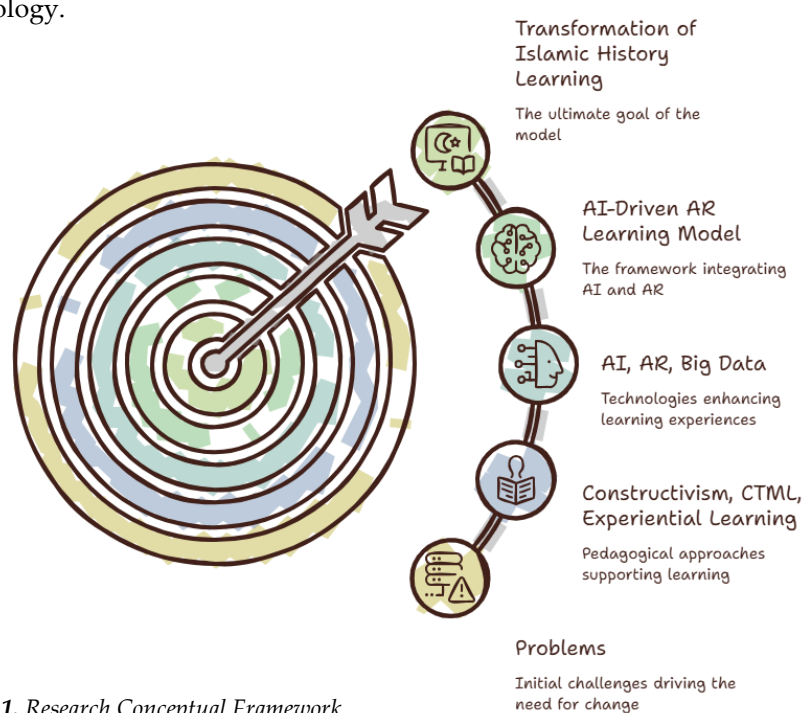


Figure 1. Research Conceptual Framework

3. FINDINGS AND DISCUSSION

2.1. *Characteristics and Weaknesses of History Teaching in Islamic Education Using Conventional Approaches*

The analysis shows that history teaching in Islamic Education is still dominated by a narrative, lecture-based approach and emphasizes memorization of event chronologies. This characteristic places the teacher as the center of information, while learners act as passive recipients. Material delivery tends to be linear and textual, resulting in minimal exploration of the spatial, social, and cultural contexts of historical events (Nuraiman dkk., 2024; Pasaribu dkk., 2025). As a result, students' historical imagination and critical thinking skills do not develop optimally (Abrar dkk., 2025). This condition reflects a gap between the applied learning model and the needs of the digital generation, who are accustomed to interactive visualization and immersive experiences (Rekan dkk., 2025).

In constructivist theory, knowledge is not viewed as something that is simply transferred in one direction from teacher to student, so the dominance of lecture-based methods tends to encourage passive learning when students merely become recipients of information (O'Connor, 2022). Constructivism asserts that knowledge is actively constructed through reflection, experience, and the individual's interaction with their environment, rather than through passive acceptance of lecture content (Chand, 1995). When students only listen without explorative engagement such as asking questions, problem-solving, discussion, or connecting material to prior knowledge, the process of meaning construction becomes limited and shallow because learning should be an active mental activity, not merely the absorption of information (Lombardi dkk., 2021). One-way lectures also reduce opportunities for dialogue and negotiation of meaning, whereas from a social constructivist perspective, interaction and dialogue are key activities through which meaning and knowledge are co-constructed, not transmitted unilaterally. As a result, history learning tends to be oriented toward the reproduction of factual information through memorization, rather than promoting the formation of deep contextual understanding through inquiry, discussion, and collaboration activities that enable students to relate historical facts to their own experiences, perspectives, and social contexts (Kumpulainen & Rajala, 2017).

Another weakness lies in the minimal use of visualization in instruction, which contradicts the principles of cognitive theory of multimedia learning that emphasizes people learn better from a combination of words and pictures than from words alone (Mayer, 2024). This theory explains that learning is more effective when information is presented through a combination of text and visuals that are cognitively integrated, for instance by applying the multimedia and spatial contiguity principles that place text and images in close proximity. Delivering history

solely in textual form overloads the verbal processing channel in working memory without optimally utilizing the visual channel, even though CTML and cognitive load theory posit the existence of two separate channels for verbal and visual information, both with limited capacity (Kirschner, 2002). This condition can increase cognitive load because students have to process complex information using only one channel, thereby reducing the cognitive resources available for organizing and integrating meaningful information. Conversely, the use of relevant visualizations—such as diagrams, maps, or spatial models—has been shown to help students build relationships between ideas, understand spatial relations, and reduce unnecessary cognitive load when learning complex content (Anmarkrud, Andresen, & Bråten, 2019). Therefore, the lack of spatial visualization in history instruction can hinder the construction of mental models of space and time, so students' understanding of geographical context and the dynamics of historical events becomes less comprehensive.

In addition, the characteristics of the digital generation, who grow up in interactive technology environments, show learning preferences that differ from previous generations, including multitasking, intensive use of digital media, and dependence on technology-rich learning environments (Nur dkk., 2023). This situation demands an experiential learning approach based on direct experience that leverages technology and dynamic learning spaces to support contextual and collaborative learning. This generation is accustomed to simulations, interactive visuals, and technology-based exploration, such as games, social media, and virtual environments, which require active participation and rapid feedback in the learning process (Bhati & Song, 2019). Experiential learning supported by digital technology enables students to experience, explore, and reflect on historical events contextually, for example through immersive simulations, re-creation of historical events in VR, or problem-based projects that connect material to real-world situations. Thus, the mismatch between the characteristics of the digital generation and conventional approaches further emphasizes the urgency of transforming towards smart technology-based, visual-immersive learning that is interactive, collaborative, and multimodal to enhance engagement and learning outcomes.

2.2. Potential Integration of Artificial Intelligence, Augmented Reality, and Big Data in Improving the Quality of History Learning

Conceptual analyses and findings from various studies show that the integration of Artificial Intelligence (AI), Augmented Reality (AR), and Big Data holds significant potential to enhance learning quality, including in the context of history education, by providing learning experiences that are more personalized, interactive, and data-driven (Garg dkk., 2025; Lampropoulos, 2025). Artificial Intelligence in education enables the personalization of content and learning paths

based on learners' abilities, preferences, and learning patterns through adaptive learning systems, intelligent tutoring, and predictive analytics that adjust content and feedback in real time (Gligorea dkk., 2023). Augmented Reality provides three-dimensional visualizations and immersive environments that allow more contextual and interactive reconstruction of historical events, thereby increasing engagement, conceptual understanding, historical empathy, and learning retention (Challenor & Ma, 2019). Big Data in education functions as an analytics system that processes digital traces and student interaction data to predict performance, identify at-risk students, and support more targeted and evidence-based decision-making in instruction (Alghamdi & Alhaykan, 2025). The synergy of AI, AR, and Big Data creates an adaptive and immersive learning ecosystem in which content is personally tailored by AI, delivered through rich-context AR experiences, and continuously refined through Big Data analytics, leading to evidence-based learning practices that improve motivation, learning outcomes, and teaching effectiveness.

In the context of the SKI curriculum at Madrasah Aliyah, the use of AR can be more purposefully directed towards materials that pedagogically require visualization and contextual reconstruction. One example of implementation is in the topic of the Hijrah of Prophet Muhammad SAW, where AR can be used to display an interactive three-dimensional map allowing students to trace the journey route from Makkah to Madinah. In this instructional scenario, students not only observe visualizations but also independently explore key points along the journey, analyze geographic challenges, and reflect on the Prophet's missionary strategies. Thus, AR serves as a medium for experiential learning that supports the development of historical imagination and contextual understanding.

For topics on wars in Islam such as the Battle of Badr, Uhud, and Khandaq, AR can be utilized to reconstruct battlefield conditions, troop positions, and the dynamics of the strategies employed. The use of AR in this context can be integrated into problem-based learning activities, in which students are asked to analyze factors of victory or defeat based on the presented visual simulations. This approach not only enhances chronological understanding but also develops critical and analytical thinking skills with regard to historical events. Next, in the material on the development of Islamic civilization during the Umayyad and Abbasid periods, AR enables visualization of urban environments such as Baghdad or Damascus in the form of three-dimensional digital reconstructions. Learners can explore scientific advancements, architecture, and sociocultural dynamics in an immersive way. This activity can be combined with an inquiry learning approach, in which students conduct virtual observations, identify characteristics of civilization, and connect them to wider global civilizational developments.

Meanwhile, in material on the history of mosque architecture, AR can be used to display three-dimensional models of historic mosques such as the Nabawi Mosque or the Masjid al-Haram. Through direct interaction with virtual objects, students can more concretely comprehend the structures, functions, and symbolic values of Islamic architecture. This is in line with the principles of the cognitive theory of multimedia learning, which emphasizes the importance of integrating visual and verbal information to enhance conceptual understanding. In all of these scenarios, Artificial Intelligence serves as an adaptive system that analyzes students' interactions with AR content to adjust the level of material complexity, provide real-time feedback, and recommend learning pathways appropriate to individual needs. On the other hand, Big Data functions as an analytic foundation that processes student interaction data to map engagement patterns, levels of understanding, and learning difficulties both collectively and individually. Thus, the integration of AI, AR, and Big Data not only brings innovation to media, but also forms an evidence-based, adaptive, and sustainable learning ecosystem.

With these material-based implementation specifications, the use of AR in SKI learning is no longer generic or simply technologically innovative, but rather pedagogically targeted, historically contextual, and relevant to the expected learning outcomes. This simultaneously strengthens the position of the Big Data-based AI-Driven Augmented Reality Learning model as a transformational approach in Islamic history education in the digital era.

2.3. Conceptual Model of Big Data-Based AI-Driven Augmented Reality Learning in the Transformation of Islamic History Learning

The conceptual model developed in digital education is generally structured in several main layers, such as the pedagogical layer, the technological layer, and the data/analytics layer, to integrate instructional design, technology infrastructure, and data utilization in a unified manner. The pedagogical layer often builds on constructivism and experiential learning theories, emphasizing that knowledge is actively constructed through experiences, interactions with the environment, and structured reflection on those experiences (Mattar, 2018). The technological layer in the intelligent learning ecosystem includes the use of AR/VR devices as immersive visualization media, AI integration for adaptive management and content personalization, as well as the use of Big Data and cloud computing as centers for the integration and management of educational information (Strielkowski dkk., 2025). The data analytics layer serves to process learning traces for learning analytics and the continual evaluation of learning effectiveness, through analysis of student engagement, performance, and learning behavior, thereby supporting feedback and improvements to instructional design (Johar dkk., 2023). This multilayer structure underscores that technology-based learning transformation is systemic, encompassing

pedagogical, technological, and data governance dimensions, thus moving beyond mere media innovation toward comprehensive ecosystem change in learning.

The transformation from conventional to visual-immersive approaches produces significant changes in classroom dynamics. Students become active participants who can explore historical events contextually and interactively. Teachers transform into facilitators as well as data-based learning analysts. Learning processes become more reflective, as students can visually understand the relationships between space, time, and historical events. This conceptual model demonstrates that Big Data-based AI-Driven AR is capable of reconstructing Islamic history learning to be more contextual, adaptive, and relevant to the character of the digital generation.

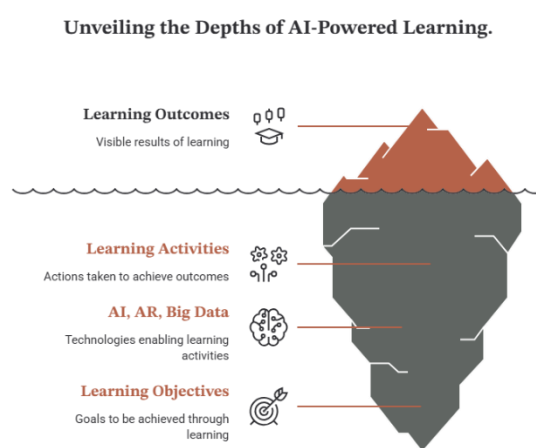


Figure 2. AI-Driven Augmented Reality Learning Model Based on Big Data

2.4. Pedagogical Implications and Implementation Challenges in the Context of Islamic Education

The pedagogical implications of this model include a shift in the learning paradigm from teacher-centered to technology-based learner-centered models. Teachers are required to possess adequate digital literacy and AI competence to effectively manage the integration of AI, AR, and data analytics in instructional design, selection of digital resources, and adaptation of instructional strategies. Learning is increasingly data-driven, so evaluation is no longer only reliant on written tests, but also utilizes learning analytics and models that quantify learning engagement by analyzing interactions, learning behavior patterns, and levels of student engagement on an ongoing basis (Ng dkk., 2023; Toshtemirova dkk., 2025). Thus, learning Islamic history not only increases cognitive understanding, but also builds reflective historical awareness, moral consciousness, and the ethical engagement of students with contemporary issues, as emphasized within the framework of critical pedagogy and the integrative model of Islamic education.

Nevertheless, the implementation of this model faces a number of structural and cultural challenges. Technological infrastructure limitations in some Islamic educational institutions may hinder the adoption of AR and Big Data-based systems. In addition, the readiness of human

resources becomes a crucial factor in ensuring optimal technology integration. Ethical challenges related to the use of student data also need to be managed with clear regulations and policies. Therefore, the success of the Big Data-based AI-Driven Augmented Reality Learning model is highly dependent on the synergy among technological readiness, teacher competence, and institutional policy support.

4. CONCLUSION

The teaching of history in Islamic Education, which still employs a conventional approach, is characterized by the dominance of the lecture method, minimal interactivity, and limited use of visual media. This condition causes students to be passive, as knowledge is positioned as something transferred unidirectionally, rather than being actively constructed as emphasized by constructivist theory. The lack of visualization in teaching also contradicts the principles of multimedia learning, which stress the importance of integrating text and images to enhance retention and conceptual understanding. In addition, the conventional approach is less relevant to the character of the digital generation, which requires a contextual, participatory, and experience-based learning environment. Thus, the transformation of Islamic history education has become an urgent necessity in facing the challenges of the digital era.

The integration of Artificial Intelligence, Augmented Reality, and Big Data presents a strategic opportunity to significantly enhance the quality of Islamic history learning. Artificial Intelligence enables personalized learning through the analysis of students' learning data, allowing materials to be tailored to the needs and comprehension levels of each individual. Augmented Reality delivers an immersive visual experience capable of reconstructing Islamic historical events more concretely and contextually. Big Data provides the foundation for evidence-based learning analytics to improve instructional effectiveness. The AI-Driven Augmented Reality Learning conceptual model based on Big Data is therefore able to transform Islamic history learning from a textual-narrative approach to an adaptive and participatory visual-immersive approach.

The pedagogical implications of this model demand a paradigm shift for teachers, from being the center of information to becoming facilitators, designers of learning experiences, and learning data analysts. This transformation also requires the readiness of digital infrastructure, educators' technological literacy, and institutional policy support within the context of Islamic Education. Implementation challenges include resource limitations, gaps in technology access, and the potential devaluation of values if technology is not integrated on the foundation of Islamic ethics. Therefore, model development must remain oriented to the spiritual, historical, and moral values that are the essence of Islamic Education. With an integrative and value-based

approach, the digital transformation of Islamic history learning can become a strategic instrument in cultivating a technologically literate yet character-driven Muslim generation.

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