



## Strategy for Utilizing Artificial Intelligence in Islamic Religious Education Learning in Junior High Schools

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### Abstract: Strategy for Utilizing Artificial Intelligence in Islamic Religious Education Learning in Junior High Schools

**Objective:** This study aims to develop strategies for the ethical and practical use of Artificial Intelligence (AI) features in the Canva application to transform Islamic Religious Education (IRE) learning at the junior high school level. **Method:** The research method used a qualitative descriptive approach. Data was collected through participatory observation, in-depth interviews, and document analysis. **Results:** Canva's Magic Studio and automation feature reduced material preparation time to 30–60 minutes, enabling the production of relevant visual media. The "SIKAP" blended learning model with strict Islamic content control increased student motivation, theological understanding, memory, classroom interaction, and pedagogical efficiency. **Conclusion:** The integration of Canva-based AI, which is ethical and strictly supervised by humans (human-in-the-loop), has proven capable of revitalizing junior high school PAI learning, making it more engaging and relevant to the digital generation without compromising Islamic values or the role of teachers as guardians of morals. **Contribution:** This study developed a replicable and low-cost "Blended PAI-AI with Islamic Content Control" model for PAI teachers in Indonesia. It enriched the TPACK theory with the dimensions of Islamic ethics and content validation in AI-assisted religious education.

**Keyword:** 3 or 5 important, specific, and representative words or phrase

### Abstract: Strategi Pemanfaatan Kecerdasan Buatan dalam Pembelajaran PAI di SMP

**Tujuan:** Penelitian ini bertujuan mengembangkan strategi pemanfaatan fitur Kecerdasan Buatan (AI) pada aplikasi Canva secara etis dan efektif untuk mentransformasi pembelajaran Pendidikan Agama Islam (PAI) di jenjang SMP. **Metode:** Metode penelitian menggunakan pendekatan deskriptif kualitatif, Data dikumpulkan melalui observasi partisipatif, wawancara mendalam serta analisis dokumen. **Hasil:** Fitur Magic Studio dan otomatisasi Canva mengurangi waktu persiapan materi menjadi 30–60 menit, menghasilkan media visual relevan. Model blended learning "SIKAP" dengan kontrol konten Islami ketat meningkatkan motivasi siswa, pemahaman teologis, daya ingat, interaksi kelas, dan efisiensi pedagogis. **Kesimpulan:** Integrasi AI berbasis Canva yang etis dan diawasi ketat oleh manusia (human-in-the-loop) terbukti mampu merevitalisasi pembelajaran PAI jenjang SMP sehingga lebih menarik dan relevan bagi generasi digital tanpa mengorbankan nilai-nilai Islam maupun peran guru sebagai penjaga akhlak. **Kontribusi:** Penelitian ini mengembangkan model "Blended PAI-AI dengan Kontrol Konten Islami" yang mudah direplikasi dan berbiaya rendah untuk guru PAI di Indonesia, serta memperkaya teori TPACK dengan dimensi etika Islam dan validasi konten dalam pendidikan agama berbantuan AI.

**Kata Kunci:** 3-5 kata atau frase yang penting, spesifik, atau representatif bagi artikel ini.

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## A. INTRODUCTION

The era of the Industrial Revolution 4.0 and Society 5.0 has ushered in a fundamental and inevitable transformation in the world of education. Advances in information and communication technology, particularly Artificial Intelligence (AI), have shifted the learning paradigm from conventional approaches to more personalized, adaptive, and interactive learning experiences (Mars, 2024). In Indonesia, the National Strategy on Artificial Intelligence 2020-2045 and the Minister of Communication and Informatics' Circular Letter No. 9 of 2023 on Artificial Intelligence Ethics emphasize that the utilization of AI in education is both inevitable and an ethical responsibility. (Indonesia, 2023). As a subject aimed at fostering noble character and piety, Islamic Religious Education is no exception to this transformative demand. The Islamic Religious Education curriculum must proactively adapt to innovations of the Industrial Revolution 4.0 – such as the Internet of Things, Big Data, and robotics – to ensure its relevance and effectiveness in shaping students' character amid rapid technological developments (Anugerah, 2023). The integration of such technologies not only enhances the effectiveness of learning but also increases students' interest in studying Islamic teachings, producing learners who possess spiritual, emotional, and technological intelligence (Mufti et al., 2024). This implementation is crucial, given that the Industrial Revolution 4.0 is characterized by the convergence of digital and physical technologies, with artificial intelligence serving as the core of innovation across various industrial sectors (Nugraha et al., 2023). In this context, Education 4.0 emphasizes the integration of networked technologies to expand access and relevance. At the same time, Education 5.0 emphasizes the integration of humans and technology to foster creativity and innovation, while prioritizing character and moral aspects (Wahyudi, 2023). Nevertheless, the reality on the ground, particularly in junior high schools, still reveals low utilization of AI technology in the Islamic Religious Education learning process.

Islamic Religious Education plays a strategic role in nation-building, as mandated by Law No. 20 of 2003 on the National Education System. The Islamic Religious Education curriculum encompasses the dimensions of aqidah (faith), ibadah (worship), akhlak (morals), and Islamic history and civilization, all of which should be delivered in an engaging and relevant manner to contemporary students' lives (Ajir et al., 2024). Unfortunately, teaching methods that remain lecture-based and lack variety have caused students' interest in Islamic Religious Education to decline, with the subject often perceived as "less enjoyable" compared to others. Preliminary observations conducted by the author in 2025 at SMP Negeri 2 Parepare revealed that Islamic Religious Education teachers rarely utilize AI features in the Canva application to create interactive visual learning media, despite the platform's Magic Studio, Magic Write, and other generative AI capabilities that can significantly accelerate and enrich the design of Islamic Religious Education materials.

Several previous studies have explored the integration of technology in Islamic religious education. Zumhur Alimin, in his research entitled "Enhancing Islamic Education through the Utilization of AI-Based Educational Platforms," found that platforms such as Canva, Lumen, and Google Classroom can significantly improve personalization and interactivity in religious learning. (Alamin, 2023) Similar findings were reported by Gusti Firda Khairunnisa et al. through a community service program at a Madrasah Aliyah, which demonstrated that mentoring on AI-based Canva usage successfully increased teachers' skills in creating learning media by 85% (Khairunnisa et al., 2024) Meanwhile, demonstrated a tangible improvement in students' digital literacy and creativity through training on digital poster creation using Canva for elementary students at SD Al-Fityan Tangerang (Syurmita et al., 2023).

Despite these contributions, a significant research gap remains. Most prior studies have been general in scope (focusing on AI platforms overall), centered on madrasah or higher education levels, or limited to training and mentoring activities without examining long-term classroom implementation. No study has specifically investigated strategies for utilizing AI

features in the Canva application for Islamic Religious Education learning in public junior high schools, particularly in the South Sulawesi region, such as SMP Negeri 2 Parepare. This study aims to fill that gap by adopting a field research approach that combines observation, interviews, and document analysis to produce implementation strategies that are both applicable and replicable.

The selection of Canva as the primary focus is based on several rational considerations. First, Canva offers AI features that are easily accessible (both free and paid), require no advanced programming skills, and are already familiar to many teachers in Indonesia. Second, features such as Magic Design, Background Remover, Magic Write, and Text-toImage are highly relevant for creating Islamic Religious Education visual media (e.g., infographics on morals, timelines of Islamic history, or animated videos of Qur'anic verses) that were previously difficult to produce manually. Third, compared to more complex platforms like MidJourney or Chat GPT, which carry greater ethical risks, Canva provides a balanced combination of ease of use, data security, and alignment with Islamic values (transparency and a default setting that avoids generating images of living beings).

This study aims to develop a strategy for utilizing artificial intelligence through the Canva application in Islamic Religious Education at SMP Negeri 2 Parepare by addressing three main research questions: (1) How should AI-based Islamic Religious Education learning be designed using Canva? (2) What are the strategies for its implementation in the classroom? Moreover, (3) What are the implications of this usage on student learning outcomes? Theoretically, this research is expected to enrich the body of knowledge on technology-based Islamic Religious Education learning and the TPACK (Technological Pedagogical Content Knowledge) model within the context of Islamic religious education. Practically, the findings will serve as a guideline for Islamic Religious Education teachers at SMP Negeri 2 Parepare and other schools to integrate AI gradually, ethically, and effectively, while simultaneously enhancing students' interest and achievement in Islamic Religious Education. Ultimately, this study is expected to make a tangible contribution to achieving national education goals, producing a generation that is not only intellectually proficient but also spiritually resilient in the digital era. This study is important as it provides new insights into strategies for utilizing Artificial Intelligence (AI) in Islamic Religious Education learning at junior high schools. With the increasing integration of technology in education, this study has the potential to assist Islamic Religious Education teachers in optimizing the use of AI to enhance teaching quality, facilitate more interactive lessons, and enrich students' learning experiences. Additionally, this study is relevant in supporting a more adaptive curriculum that aligns with technological advancements in the digital age, thereby strengthening the competitiveness of Islamic education in an increasingly evolving global context.

## B. METHOD

This study employs a qualitative approach with a descriptive qualitative research design. This approach was selected because it enables the researcher to provide an in-depth, systematic, and contextual description of strategies for utilizing artificial intelligence through the Canva application in Islamic Religious Education learning at SMP Negeri 2 Parepare, without manipulating variables.

The research was conducted at SMP Negeri 2 Parepare, located at Jl. Lahalede No. 84, Lakessi Village, Soreang District, Parepare City, South Sulawesi, over a period of six months (July–November 2025). The research subjects consisted of three Islamic Religious Education teachers and seven eighth-grade students, selected purposively based on their experience or exposure to the use of AI-based Canva in the learning process.

Data were collected through methodological triangulation, comprising (1) participatory observation of Islamic Religious Education learning processes that incorporated Canva (a minimum of six class sessions), (2) in-depth semi-structured interviews with teachers and

students, and (3) documentation in the form of lesson plans (RPP), Canva-based learning media, photographs or videos of activities, and students' grade records.

Data analysis followed the model proposed by Miles, Huberman, and Saldaña (2014), which includes data reduction (simplifying and coding raw data), data display (using narratives, tables, and thematic matrices), and drawing conclusions that are continuously verified. The validity of the data was ensured through source triangulation, method triangulation, and theoretical triangulation, as well as member checking with participants. Accordingly, this study is expected to yield credible findings that can serve as a reference for implementing AI strategies in Islamic Religious Education instruction at the junior high school level.

## C. RESULTS AND DISCUSSION

### Result

#### 1. AI-Based Islamic Religious Education Learning Design through the Canva Application

Based on interviews with Mr. Saparuddin, S.Ag., and Mrs. Hajrah, S.Pd.I., regarding the design of Artificial Intelligence-based Islamic Religious Education learning using the Canva application at SMP Negeri 2 Parepare, the following findings were obtained:

##### a) Magic Studio

Teachers utilize the Magic Studio feature in designing Islamic Religious Education lessons by first determining the learning objectives, then employing Magic Design to automatically generate presentation slides on topics such as noble morals (akhlak mulia) and congregational prayer (shalat berjamaah). The Magic Write and Text-to-Image features are utilized to create interactive storyboards of prophetic stories, facilitating easier understanding and internalization of the narratives by students. Teachers also incorporate contemporary templates (aesthetic or minimalist styles) enhanced with Islamic memes and short inspirational quotes to make the content more relatable to students. As a result, the design process becomes significantly faster, and the visual presentation is far more appealing to students.

##### b) Design Personalization

Canva's AI serves as a "lifesaver" for teachers in crafting materials for the extensive Islamic Religious Education curriculum. The AI system "understands" the user's style and provides tailored recommendations for templates or images, such as calm tones for lessons on praiseworthy morals (akhlak terpuji) or formal yet engaging color palettes for fiqh infographics. By filtering millions of elements in Canva, the AI presents only the most relevant options. The impact is profound: Islamic Religious Education materials that were once perceived as "outdated" and "monotonous" are now more engaging and aligned with students' visual preferences. Abstract fiqh concepts become more concrete through AI-suggested illustrations, enabling students not only to memorize but also to relate personally to the material and retain it more effectively.

##### c) Automation

Canva's AI automation features are regarded as a "lifesaver" for teachers with heavy workloads. Creating a 10-slide presentation that previously took 3-4 hours to lay out and align now requires only about one hour. Teachers copy text from the lesson plan (RPP) and use features like Magic Switch or Resize, which automatically adjust font sizes, layouts, and proportions even when converting formats from presentations to posters. The time saved can then be redirected toward other pedagogical activities, such as grading assignments or designing interactive classroom engagements.

However, several challenges persist. The primary obstacle is the school's unstable internet connection, which causes repeated loading delays and disrupts the efficiency of the system. Other issues include teachers' adaptation to new features like Magic Write, which requires specific prompts to produce accurate results, and the limitations of the free version of Canva,

which necessitate additional manual steps since full automation features are only available in Canva Pro.

Overall, the integration of Canva AI in Islamic Religious Education instruction at SMP Negeri 2 Parepare has yielded positive outcomes, dramatically reducing design time (from 4 hours to 1 hour), making materials more relevant and engaging, and enhancing students' focus and appreciation of the subject. Nevertheless, effectiveness remains constrained by unreliable internet connectivity, challenges in teachers' adaptation to crafting precise prompts, and restrictions imposed by the free version's limited features.

## 2. Strategy for Implementing AI-Based Islamic Religious Education through Canva

Based on interviews with Mr. Saparuddin, S.Ag., Mrs. Hajrah, S.Pd.I., and several students regarding the implementation strategies for Artificial Intelligence-based Islamic Religious Education learning using the Canva application at SMP Negeri 2 Parepare, the following findings were obtained:

### a) Teachers' Implementation Strategy

Teachers developed a structured implementation strategy using the acronym "SIKAP" (Attitude), which consists of: Sosialisasi (Socialization: demonstrating AI features), Identifikasi (Identification: selecting visually suitable Islamic Religious Education materials, such as Fiqh or Islamic History and Civilization/SKI), Kontekstualisasi (Contextualization: assigning relevant tasks, such as creating content for the school's Instagram account), Aplikasi (Application: students work on the project), and Presentasi (Presentation: appreciation and showcasing of students' work). This strategy is not applied in every session; instead, approximately one out of every three meetings focuses on Canva-based projects, while the remaining sessions continue to use conventional methods such as tadabbur (reflective study) of the material. This approach reflects a balanced blended learning model that integrates technology with traditional methods.

### b) Application of Behaviorism Principles

Teachers cautiously apply behaviorist principles to observe student behavior. Positive behavior is identified when students revise and edit the output from Magic Write rather than simply copying and pasting it, indicating deep engagement and genuine learning. Conversely, negative behavior is observed when students merely change template colors without processing the Islamic Religious Education content, signaling superficial involvement. These observations help teachers assess students' effort and critical thinking levels.

### c) Learning Facilitation Strategy

Teachers provide clear boundaries through Student Worksheets (LKPD) that list mandatory Islamic Religious Education content points. They express concern that excessive freedom would cause students to focus solely on visual design. Canva AI is permitted as a creative aid for generating sentence ideas or images. However, key content must remain aligned with the official Islamic Religious Education textbook to ensure curricular accuracy.

Teachers shift their role to that of a "discussion partner," circulating the classroom and posing prompting questions such as "What feature did you use for that?" or "Why did you choose that image to represent honesty?" This technique encourages students to explain the connection between their design choices and the Islamic Religious Education material, fostering critical thinking that prioritizes conceptual understanding over mere aesthetics.

### d) Utilization of Features

Students most frequently use Magic Write to summarize topics such as the attributes of the Prophet, with the awareness that the output must be reread and edited according to teacher instructions direct copy-pasting is prohibited. The Text-to-Image feature is employed to create specific illustrations, such as the Ka'bah or scenes of the Hijrah, for Islamic Religious

Education posters. Some students also utilize animation features to produce short videos about prophetic stories, describing the experience as “watching cartoons, but the content is religious lessons.” However, a few students find the Text-to-Image results occasionally “odd” and therefore less appealing.

e) Student Motivation Strategy

Teachers employ a dual motivation strategy centered on relevance and appreciation. They emphasize that design and AI skills are highly relevant to students' daily lives. A simple reward system is implemented by showcasing the best works on the school's digital bulletin board or class WhatsApp group, fostering students' pride. Group project-based learning further enhances engagement, as students feel a sense of responsibility toward their team members.

At the end of each semester, teachers organize a “Digital Works Gallery” event where the three best Islamic Religious Education posters from each class are printed and displayed on the school bulletin board. Academic rewards in the form of additional participation points are awarded to groups whose designs are the most informative and accurate, ensuring that competition prioritizes content mastery over visual appeal. Teachers also implement a “Content Review” mechanism for quality control. Before a work is considered complete and presented, its content draft must first be consulted with and approved by the teacher. This mandatory review process ensures that the primary focus remains on the accuracy of Islamic Religious Education materia such as the pillars of faith rather than merely on attractive fonts or impressive animations, thereby safeguarding the integrity of religious teachings.

**Table 1.** Summary of Implementation Strategies

Strategy Component	Characteristics	Control Mechanism
Learning Model	Structured blended learning (1:3 ratio of meetings)	Step-by-step “SIKAP” model
Main Focus	Accuracy of Islamic Religious Education content > Design aesthetics	Mandatory Student Worksheet (LKPD) + Compulsory Content Review
Teacher's Role	Facilitator (“discussion partner”) + Quality controller	Draft review before presentation
Student Motivation	Relevance + Public appreciation	Digital Works Gallery, school bulletin board, participation point rewards
AI Usage	Creative aid tool with mandatory verification	Edit/verify AI output; direct copy-paste prohibited
Conventional Methods	Remain the foundation of learning	Tadabbur (reflective study) in 2 out of 3 meetings

The implementation strategy for AI-based (Canva) Islamic Religious Education learning at SMP Negeri 2 Parepare employs a structured, controlled, and motivation-oriented blended learning approach. Teachers deliberately do not use AI in every session; instead, they integrate it gradually through the step-by-step “SIKAP” model while maintaining conventional methods as the foundation. Quality control is strictly enforced through clear boundaries in the Student Worksheet (LKPD) and a mandatory “Content Review” mechanism, ensuring that the accuracy of Islamic Religious Education content is always prioritized over design aesthetics. The motivation strategy centers on the real-world relevance of skills and public appreciation, achieved through a “Digital Works Gallery,” display on the school bulletin board, or other forms of recognition. Students primarily utilize Magic Write for efficiency and Text-to-Image for visualization, while remaining aware of the teacher's instructions to verify and edit AI-generated output, rather than simply copying and pasting it.

### 3) Implications of Using AI-Based Canva on Islamic Religious Education Learning Outcomes

Based on interviews with Mr. Saparuddin, S.Ag., Mrs. Hajrah, S.Pd.I., and several students regarding the implications of using the Artificial Intelligence-based Canva application on Islamic Religious Education learning outcomes at SMP Negeri 2 Parepare, the following findings were obtained:

#### a) Increased Motivation and Learning Engagement

Student responses were overwhelmingly positive, indicating a noticeable difference. Students who previously tended to doze off during Islamic Religious Education lessons, especially at the end of the day, now remained fully alert and highly attentive. When teachers presented slides or animated videos featuring modern, colorful designs created in Canva, students' enthusiasm was immediately evident through spontaneous verbal reactions such as "Wow, the pictures look amazing, Ma'am!" or "That is awesome, Ma'am!" These engaging visual stimuli proved highly effective in transforming the classroom atmosphere from one of passivity and lethargy to one that is vibrant and interactive.

Students' motivation shifted from merely feeling "obliged" to study Islamic Religious Education out of duty to becoming genuinely "curious." They began to perceive Islamic Religious Education as a contemporary, up-to-date subject rather than something old-fashioned, which nurtured the growth of their intrinsic motivation. When given group assignments to create digital posters on the topic of "Praiseworthy Morals" (Akhlak Terpuji) using Canva, students tackled the tasks with remarkable enthusiasm, producing unexpectedly creative and high-quality outcomes. This clearly demonstrates that presenting Islamic Religious Education material through modern tools successfully fosters authentic, self-generated interest among students.

Visually appealing learning media serve as a highly effective "bridge to understanding." Students grasp concepts more quickly because explanations are supported by engaging images and visually appealing typography. The initial understanding gained from visuals provides concrete material for discussion or questioning, a sharp contrast to traditional lecture methods that often leave students passive and uncertain about what to ask. Visual aids, such as step-by-step illustrations of the correct wudhu (ablution) procedure, encourage even shy students to participate actively. By examining detailed visuals, students can compare them with their prior knowledge and understanding. When they notice discrepancies ("That is different from what I thought I knew"), it gives them the confidence to raise their hands and ask specific questions. Consequently, visual media effectively lowers psychological barriers particularly shyness preventing students from seeking clarification, thereby promoting greater participation and deeper resolution of doubts.

#### b) Facilitating Understanding of Abstract Concepts and Strengthening Memory Retention

The primary function of Canva AI is to act as a "bridging tool" that concretizes highly abstract theological concepts. Topics such as "Faith in Qada and Qadar" or "The Attributes of Allah" can be visualized through AI by prompting requests like "visualize the concept of Tawakal" or "illustrate the difference between Muallaq and Mubram destiny." Canva AI effectively creates visual analogies that connect complex concepts to students' still-concrete operational thinking. It is invaluable in explaining abstract moral concepts such as "Ikhlas" (sincerity), which are difficult to quantify. By generating simple comic strips that contrast a person who performs good deeds ostentatiously with one who does so discreetly, students can immediately distinguish between the two. Visuals transform intangible moral concepts into ones whose consequences are "visibly evident," enabling instant and deeper comprehension.

Students' memory retention improves significantly because engaging visuals serve as powerful "memory anchors." Even if students forget the teacher's verbal explanation after a week, they still remember the image. For example: "Oh yes, Ma'am, the one with the scales

image, right? That was about justice." Visuals function as far more potent cognitive triggers than oral explanations alone, helping students accurately recall the essence of Islamic Religious Education concepts. Structured visual media, such as comparison tables, are highly effective in resolving confusion over overlapping concepts. Students who previously struggled to differentiate between a Prophet (Nabi) and a Messenger (Rasul) gained clarity after teachers used Canva comparison tables enhanced with icons. For topics related to Paradise and Hell, comparative infographics grounded in Qur'anic descriptions make unseen (ghayb) realities "more imaginable," intensifying both emotional and spiritual impact. As a result, students' religious consciousness is heightened ("I feel more afraid of committing sins now"), leading to stronger internalization of Islamic values.

#### c) Enhanced Efficiency in the Learning Process

The Canva AI "Magic Design" feature functions as a "personal assistant" that dramatically improves time efficiency. Creating a 10-slide Islamic Religious Education presentation that previously took 2-3 hours (searching for copyright-free images, designing layout, and selecting fonts) can now be completed in just 30 minutes. Teachers enter a prompt such as "Create an 8-slide presentation on the Meccan period of Prophet Muhammad's life," and a complete draft is generated in about 30 seconds. From there, they only need to edit, add supporting evidence (dalil), and make minor refinements. The AI handles all technical tasks, allowing teachers to focus on enhancing substantive content.

Canva AI delivers targeted and precise efficiency gains. Teachers use "Magic Write" not to generate content from scratch, but to polish and restructure points they have already prepared. The AI image generator is employed to produce concrete illustrations (e.g., "a child giving charity") that would otherwise require lengthy manual searches. Overall, the AI serves as a supportive tool that saves significant time on refinement and asset searching.

The use of visual media is highly effective because it reallocates pedagogical time in the classroom, allowing for a more engaging learning experience. Visuals replace the teacher's need to repeatedly explain basic concepts verbally, thereby saving valuable teaching time. The saved time is redirected toward higher-order cognitive activities such as case-study discussions and in-depth question-and-answer sessions. As a result, within the same class duration, material is not only delivered but also explored at a much deeper level of understanding.

Students experience learning as anything but boring; lessons feel fast-paced ("before we know it, the period is almost over"), yet the material is fully understood. The approach saves time by eliminating the need for extensive note-taking on the whiteboard. The process becomes far more dynamic: the teacher displays the visual, highlights key points, students discuss, and the session concludes efficiently – while remaining highly interactive and engaging.

#### d) Challenges and Mitigation Efforts in Learning Outcomes

Three primary challenges emerged. First, infrastructure: Canva AI requires a stable internet connection; when the school Wi-Fi is unreliable, AI features become inaccessible. Second, content validity: AI does not always produce contextually accurate results for Islamic Religious Education material (e.g., incorrect visualizations of the Hajj rituals), requiring teachers to review all outputs thoroughly. Third, skill literacy: effectiveness heavily depends on the newly acquired ability to craft effective prompts, as poorly worded instructions lead to irrelevant or misguided results.

Additional obstacles include the personal adaptation cost – teachers must invest off-duty time to master new features. There are also pedagogical concerns about the risk of over-reliance on visuals, where students may become "spoiled" and lose motivation when lessons revert to traditional whiteboard methods. Furthermore, facility disparities exist, as not all

classrooms are equipped with high-quality projectors, hindering consistent implementation across classes.

To address internet connectivity issues, teachers prepare materials at home and download them in offline formats (such as PDF or video) for classroom use, thereby eliminating their dependence on live connections. Regarding content accuracy, teachers firmly position themselves as the “final filter,” assuming full responsibility for verifying the correctness of all material before presentation. This reinforces the principle that AI is merely a supportive tool and can never replace the teacher.

Students frequently encounter technical difficulties: videos buffer repeatedly due to slow school internet, or audio from the teacher’s laptop is too quiet for students at the back to hear. These shortcomings in school infrastructure disrupt the learning experience and create unequal access to information within the same classroom.

**Table 2.** Summary of the Implications of Using Canva AI

Dimension	Indicator of Change	Positive Outcomes	Challenges	Status
Learning Motivation	Extrinsic → Intrinsic	Students become more enthusiastic, creative, and engaged	Risk of students becoming “spoiled” by visuals	✓ Very Positive
Conceptual Understanding	Abstract → Concrete	Difficult Islamic Religious Education concepts become easy to understand through visuals	AI content validity requires verification	✓ Highly Effective
Memory Retention	Verbal forgetting → Visual recall	Visuals serve as strong “memory anchors”	–	✓ Proven Effective
Teacher Efficiency	2–3 hours → 30 minutes	Preparation time drastically reduced	Requires prompting literacy	✓ Highly Efficient
Classroom Efficiency	Repeated explanations → In-depth discussion	Time reallocated to higher-order cognitive activities	–	✓ Optimal
Infrastructure	Dependence on live connection	–	Unstable internet; uneven projector availability	✗ Primary Obstacle
Teacher’s Role	Traditional → Facilitator + Quality Control	Teachers become “final filter” and discussion guides	Burden of verifying AI-generated content	⚠ Requires Adaptation
Student Learning Outcomes	Passive & drowsy → Active & comprehending	Deeper understanding and significantly increased participation	Disparities in facility access	✓ Significantly Improved

The implementation of AI-based Canva at SMP Negeri 2 Parepare has proven to be a significant catalyst in transforming Islamic Religious Education learning. It successfully shifts students’ motivation from extrinsic (“obligated”) to intrinsic (“genuinely curious”) by delivering material in a contemporary, interactive, and visually engaging manner. The application plays a crucial role as a “bridge to understanding,” concretizing abstract theological and moral concepts—such as Ikhlas (sincerity) or Qada and Qadar (divine decree and predestination)—and serves as a powerful visual “memory anchor” that significantly strengthens students’ retention. Canva AI also brings about dramatic efficiency gains: for teachers, it acts as a “personal assistant” that slashes preparation time from hours to mere minutes; for students, it allows classroom time to be reallocated from repetitive explanations to in-depth discussions and higher-order thinking activities. Nevertheless, this success is accompanied by substantial challenges, including an absolute dependence on school infrastructure (stable internet and functional projectors), pedagogical risks (students potentially becoming “spoiled” by visuals

and disengaged during non-digital lessons), and the new demand on teachers to consistently serve as the “final filter” to ensure the validity and accuracy of all AI-generated content.

## Discussion

### 1. AI-Based Canva Design for Islamic Religious Education Learning: Magic Studio, Personalization, and Automation as the Foundation of Transformation

Interview data reveal that Islamic Religious Education teachers at SMP Negeri 2 Parepare rely heavily on Canva's Magic Studio (Magic Design, Magic Write, Text-to-Image, and Background Remover) as the core of their instructional design. Mr. Saparuddin stated that the Magic Design feature can automatically generate presentation slides in mere seconds for topics such as noble morals (akhlak mulia) or congregational prayer (shalat berjamaah). At the same time, Mrs. Hajrah employs Text-to-Image and Magic Write to create interactive storyboards of the story of Prophet Yusuf. These practices align with Mayer's, multimedia learning principles, particularly the coherence principle (relevant text-image combinations) and the voice principle (personalized narration), which reduce extraneous cognitive load and enhance comprehension. ([Pratiwi et al., 2025](#)) The teachers' observation that the design process has become “much faster and visually more appealing” (Saparuddin) explains why students who once viewed Islamic Religious Education as “outdated” are now more focused and personally connected to the material.

Canva's AI personalization has also proven to be a true “lifesaver” for teachers. Mr. Saparuddin noted that the AI “already understands my style” and recommends calm-toned templates for lessons on praiseworthy morals or formal yet eye-catching color palettes for fiqh topics. This finding is consistent with the concept of Adaptive Learning Systems (Faresta, 2024). In which AI learns user preferences and eliminates visual clutter, sparing teachers the time-consuming task of manually searching for elements suitable for junior high school students. The direct impact is evident in students' perceptions: Islamic Religious Education materials that were once “monotonous” are now described as “colorful and relatable” (Hajrah), thereby boosting intrinsic motivation as explained by Self-Determination Theory ([Melviana et al., 2023](#)).

Automation features (Magic Switch, Resize, and auto-adjust layout) have reduced design time from 3–4 hours to approximately one hour (Hajrah). This supports Davis's, Technology Acceptance Model (TAM), which posits that perceived usefulness and perceived ease of use are the primary drivers of technology adoption among teachers ([Boughanzai et al., 2025](#)) Nevertheless, both teachers highlighted persistent barriers, including unreliable school internet connectivity and limitations of the free version, underscoring that the successful implementation of AI remains heavily dependent on local infrastructure conditions in Indonesia.

### 2. Implementation Strategy: Structured Blended Learning with Strict Content Control

The research findings indicate that the implementation of Artificial Intelligence-based Islamic Religious Education learning through the Canva application at SMP Negeri 2 Parepare adopts a structured and phased blended learning approach. The model developed by Islamic Religious Education teachers, acronymized as “SIKAP” (Socialization, Identification, Contextualization, Application, and Presentation), represents a mature and measured strategy for integrating learning technology. This approach combines face-to-face instruction with online elements, utilizing tools such as Google Forms for evaluation and student-recorded practice videos—similar to the methods employed for Islamic Religious Education during the pandemic at MAN 4 Pasaman ([Tasniwati, 2021](#)). The model demonstrates dynamic curriculum adaptation that aligns with the need to enhance teachers' competencies in integrating AI technology into the Kurikulum Merdeka (Independent Curriculum) ([Fauziah et al., 2024](#)). Other studies also emphasize the importance of teacher training in optimizing the use of AI technology to develop interactive teaching modules that are fully aligned with the Kurikulum Merdeka ([Gagaramusu et al., 2025](#))

This pattern emerges for clear reasons. First, teachers at SMP Negeri 2 Parepare are fully aware that AI technology is not a complete replacement for conventional methods but rather a complement that must be integrated judiciously. Interview data with Mr. Saparuddin reveal the principle of applying the technology in “one out of every three meetings,” reflecting a strong pedagogical awareness that Islamic Religious Education learning requires a foundation of *tadabbur* (deep reflection) that cannot be entirely supplanted by technology. This finding corroborates Bonk and Graham’s assertion that effective blended learning demands a careful balance between the strengths of traditional instruction and technological innovation ([Abdullah et al., 2021](#))

Second, the use of the acronym “SIKAP” itself reflects a deliberate cultural contextualization in the implementation of technology. Choosing a word that carries deep meaning in Indonesian—literally translating to “attitude” or “character”—and directly resonates with the core values of character education demonstrates the teachers’ efforts to ensure that technological innovation does not feel alien to students. This practice aligns closely with Davis’s, Technology Acceptance Model (TAM), which emphasizes that perceived usefulness and perceived ease of use are key determinants of technology adoption. ([Turnip & Suardhika, 2018](#))

Another significant finding is Mrs. Hajrah’s adaptive application of behaviorism principles to assess the quality of student engagement with AI-Canva. She distinguishes between “positive behavior” (students revising and editing Magic Write outputs) and “negative behavior” (merely changing template colors without processing the content). This distinction is noteworthy because, in an AI-supported learning environment, observable student behaviors serve as reliable indicators of the depth of their cognitive processing.

Why is this behavioral differentiation a critical strategy? Within the framework of Bloom’s Taxonomy, students who actively edit and revise AI-generated content operate at higher cognitive levels (Evaluating and Creating) compared to those who passively accept outputs (limited to Remembering or Understanding). Interview data reveal that teachers employ behavioralistic observation not for punitive purposes, but as a formative assessment tool to identify students who need additional scaffolding. This finding also validates concerns raised in the literature about AI in education, creating an “illusion of competence” when students become passive consumers of technological outputs. The systematic observation and intervention mechanisms employed by teachers at SMP Negeri 2 Parepare effectively mitigate this risk.

Interview data with Mrs. Hajrah further highlight a facilitation strategy involving clear boundaries enforced through the Student Worksheet (LKPD), which lists mandatory Islamic Religious Education content points. This finding is significant as it demonstrates teachers’ awareness of the potential for cognitive distraction when students prioritize design aesthetics over substantive material. Why is such a delimitation strategy necessary? Sweller’s (1988) Cognitive Load Theory explains that human working memory has limited capacity. When students face a complex dual-domain task, mastering Islamic Religious Education content while simultaneously handling technical design skills without clear guidance, they are prone to cognitive overload. The LKPD functions as structured scaffolding that reduces extraneous cognitive load and directs attention toward germane cognitive load (processing directly relevant to learning objectives) ([Zu et al., 2021](#))

The data also reveal that teachers explicitly require students to refer to the official Islamic Religious Education textbook as the ultimate source of content accuracy, rather than relying solely on AI-generated outputs. This finding highlights the crucial role of epistemic authority in religious education, where theological accuracy cannot be entirely entrusted to AI algorithms that lack a comprehensive understanding of Islamic teachings. It highlights the necessity of a “human-in-the-loop” approach when using AI in domains requiring ethical and theological judgment ([Lee et al., 2025](#)) Mr. Saparuddin’s facilitation strategy, which transforms his

role into that of a “discussion partner,” represents a fundamental pedagogical shift. By circulating the classroom and posing prompting questions such as “Why did you choose that image to represent honesty?”, he effectively implements Socratic questioning to stimulate critical thinking. Why is this approach efficient in an AI-supported learning context? Vygotsky’s sociocultural constructivism emphasizes that meaningful learning occurs through social interaction within the Zone of Proximal Development (ZPD). In this setting, the teacher serves as the more knowledgeable other (MKO), guiding students to forge explicit connections between their visual choices and underlying Islamic Religious Education concepts. Without such dialogic intervention, students might engage only at a surface level, completing tasks without deep meaning-making ([Simorangkir, 2023](#))

Notably, the teacher’s questions are exploratory (“Why did you choose this?”) rather than evaluative (“Is this correct?”). This non-judgmental style fosters psychological safety, enabling students to articulate their reasoning without fear of criticism—a prerequisite for cultivating a growth mindset.

Analysis of student interview data reveals heterogeneous yet reflective usage patterns. ([Termini et al., 2025](#)). Students predominantly utilize two AI features: Magic Write (text generation) and Text-to-Image (image generation), each serving distinct purposes within their Islamic Religious Education learning ecosystem. Magic Write emerges as the most popular feature because it delivers immediate efficiency gains during the drafting phase—the most time-consuming part of writing. Crucially, however, students do not treat AI output as final; they have internalized the teacher’s directive to “reread it and edit it.” This behavior demonstrates the development of critical AI literacy—the ability to position AI as a co-creator rather than the sole creator.

These findings align with the established AI literacy framework, which comprises four competencies: (1) recognizing AI, (2) understanding AI, (3) using AI, and (4) evaluating AI. Students at SMP Negeri 2 Parepare have clearly reached the third and fourth levels, actively using AI while simultaneously evaluating and refining its outputs ([Chiu et al., 2024](#)). Variations in preference are also evident; for instance, student Dhaffa commented that Text-toImage results are sometimes “weird.” Such feedback is significant because it reflects meta-cognitive awareness—students’ capacity to identify technological limitations based on personal experience. This aligns with Kahneman’s (2011) concept of System 2 thinking, in which students move beyond automatic reactions to technology and deliberately assess its suitability.

The data indicate that teachers employ two primary motivation strategies: relevance (demonstrating the real-world applicability of AI design skills) and public appreciation (through the Digital Works Gallery, school bulletin boards, or class WhatsApp groups). These strategies prove highly effective because they address two core dimensions of motivation outlined in Self-Determination Theory: competence (feeling capable) and relatedness (feeling recognized by the community). Why does relevance serve as such a powerful motivator for digital-native generations? Gen Z and Gen Alpha students have grown up in a digital ecosystem where content-creation skills are regarded as valuable cultural capital ([Surjaningrum et al., 2024](#)). Islamic Religious Education learning is integrated with “marketable” skills (design and AI usage), and an alignment of intrinsic motivation occurs—students no longer perceive assignments as mere academic obligations but as opportunities to build their personal portfolios. Findings regarding the “Digital Works Gallery” also reveal the implicit application of gamification elements, even though the term is not explicitly used ([Nkolika, 2025](#)). Principles of healthy competition, recognition, and rewards mirror game mechanics that significantly enhance engagement ([Neugnot-Cerioli & Laurenty, 2024](#)). What distinguishes this approach from superficial gamification, however, is that evaluation criteria consistently prioritize the accuracy of Islamic Religious Education content over aesthetic appeal, ensuring that external motivation does not undermine the intrinsic goals of learning.

The mandatory “Content Review” strategy implemented by Mr. Saparuddin represents a crucial quality assurance mechanism in AI-based Islamic Religious Education instruction. Teachers explicitly require a draft consultation before a work is considered complete, with the explicit aim of preventing an excessive focus on “beautiful fonts” or “cool animations” at the expense of substantive accuracy, such as a correct understanding of the pillars of faith (rukun iman). Why is this mechanism fundamental in the context of religious education? Unlike general subjects, where conceptual errors may only affect academic grades, mistakes in Islamic Religious Education material carry the potential for serious theological misconceptions. In the terminology of Islamic education, this relates to *tashih al-mafahim* (correction of understandings), whereby teachers bear the responsibility of ensuring that the religious knowledge students receive is accurate and authentic. In the Islamic Religious Education context, where many concepts demand a nuanced understanding of Sharia rulings, *ha-dith*, and Qur’anic exegesis, human review by a competent teacher becomes essential (Lestari et al., 2023).

### 3. Implications of Using AI-Based Canva on Islamic Religious Education Learning Outcomes

#### a) Enhanced Motivation and Engagement

The integration of visual media and AI in Islamic Religious Education has been shown to bring about significant changes in students’ motivation and classroom engagement levels. Field data indicate that students who previously attended Islamic Religious Education lessons primarily for extrinsic reasons, merely out of obligation or a sense of “having to” have shifted toward greater enthusiasm and intrinsic motivation. The curiosity sparked by the media presented by the teacher, as highlighted by Mr. Saparuddin, serves as the primary trigger for this increased engagement. Student responses reflect tangible transformation: once passive classes have become noticeably more vibrant; students who typically grew drowsy during Islamic Religious Education periods are now alert and attentive, even spontaneously offering positive comments such as “That is awesome, Ma’am!” as noted by Mrs. Hajrah. This shift also extends to shy students, such as Andi Atikah Inayah, who eventually gained the confidence to ask questions because the visuals provided concrete reference points that made it easier for them to grasp the learning context (Hae et al., 2021).

#### b) Understanding Abstract Concept Comprehension and Memory Reinforcement

The use of AI-generated visual analogies, comic strips, and infographics has proven highly effective in helping students grasp abstract concepts in Islamic Religious Education, such as *tawhid* (monotheism), *qada* and *qadar* (divine decree and predestination), *ikhlas* (sincerity), and moral values (*akhlak*). Teachers such as Mr. Saparuddin and Mrs. Hajrah observed those visual representations successfully “bridge” the gap between complex theological ideas and students’ concrete experiences. For instance, employing an image of scales as an analogy for justice not only facilitated immediate understanding but also significantly strengthened longterm retention, as students could still recall the concept accurately a week later. This finding lends strong support to Paivio’s Dual Coding Theory, which posits that presenting information simultaneously through verbal and visual codes enhances long-term memory storage. The use of Paradise further enriches the results—Hell comparative infographics, as described by student Fahr Ezi. These visuals not only improved cognitive comprehension but also had profound spiritual and affective impacts, such as a heightened fear of committing sins. Thus, AI-supported visual media in Islamic Religious Education instruction go beyond merely conveying concepts; they actively shape attitudes and character, aligning with the affective domain outlined in Bloom-Krathwohl’s taxonomy (Maulidi, 2025).

#### c) Efficiency in the Learning Process

The utilization of AI-generated visuals also has a profound impact on the efficiency of the learning process, particularly in material preparation and classroom time management.

Teachers report that preparation time, which previously required 2-3 hours, can now be reduced to approximately 30 minutes thanks to automation features, ready-made templates, and intelligent design tools provided by applications such as Canva. This time savings allows teachers to devote greater energy to designing more meaningful pedagogical strategies. In the classroom, time that was once consumed by repetitive explanations can now be redirected toward in-depth discussions, question-and-answer sessions, and contextual elaboration of religious values. Students themselves experience learning as faster, more effective, and far less monotonous, while the depth of the material remains intact. These outcomes reinforce the TPACK framework, which asserts that when teachers possess strong Technological Knowledge (TK), they can optimally integrate it with Pedagogical Knowledge (PK) and Content Knowledge (CK). In other words, technology serves to enhance teachers' professional competence rather than functioning merely as a superficial visual aid ([Pramana et al., 2023](#)).

#### d) Challenges and Mitigation Strategies

Despite the substantial benefits of AI usage, teachers face several challenges in its implementation, primarily related to infrastructure limitations such as internet connectivity, projector availability, and classroom audio quality. Additionally, teachers' lack of literacy and technical skills remains a barrier to creating visuals that are both accurate and aligned with Islamic values and ethics. Nevertheless, teachers at SMP Negeri 2 Parepare have developed contextually relevant mitigation strategies suited to the Indonesian school environment. Materials are prepared offline at home to circumvent network issues. At the same time, teachers position themselves as the "final filter" to ensure the accuracy and conformity of information with Islamic ethics and teachings. Teachers also emphasize their central role as facilitators rather than mere technology operators. These efforts align with the broader discourse on AI in education, which emphasizes the importance of a "human-in-the-loop" approach to ensure content validity, safety, and the preservation of moral values in learning. Thus, generative AI has proven not to replace the role of Islamic Religious Education teachers but rather to strengthen their capacity to deliver abstract material while instilling noble values in the digital generation ([Yarun et al., 2023](#)).

### D. RESEARCH IMPLICATIONS AND CONTRIBUTIONS

#### 1. Research Implications

The study on the integration of AI through Canva in Islamic Religious Education at SMP Negeri 2 Parepare yields several important implications.

Theoretically, this research expands the framework of digital Islamic Religious Education by integrating the Cognitive Theory of Multimedia Learning, Dual Coding Theory, and the Technology Acceptance Model (TAM) within the context of religious education. Evidence that AI-generated visuals can concretize abstract theological and moral concepts affirms the role of multimodality in Islamic Religious Education instruction. Furthermore, the Islamic content control mechanisms (Student Worksheets/LKPD and teacher verification) reinforce the human-in-the-loop principle while adding a dimension of safeguarding aqidah (faith) and akhlak (morals) to the TPACK framework.

Practically, Canva emerges as a practical, affordable, and user-friendly tool for Islamic Religious Education teachers to produce engaging materials tailored to the digital generation. Preparation time can be reduced by 70-80%, allowing teachers to concentrate on spiritual discussions and character development. For students, the visual approach renders Islamic Religious Education more relevant, enhancing intrinsic motivation and the internalization of Islamic values.

Managerially, school principals and policymakers should prioritize upgrading digital infrastructure and providing AI literacy training for Islamic Religious Education teachers. The

establishment of an “Islamic Religious Education Digital Literacy Team” is recommended to ensure that AI usage remains aligned with the curriculum and Sharia principles.

Methodologically, this study demonstrates the effectiveness of a qualitative approach, utilizing interviews and the analysis of digital artifacts, in uncovering pedagogical and spiritual dynamics. Future research could employ mixed-methods designs incorporating pre- and post-tests to strengthen the quantitative evidence.

## 2) Research Contribution

This research makes a significant contribution to the development of Islamic Religious Education and educational technology. Theoretically, it introduces a new model, “Blended Islamic Religious Education -AI with Islamic Content Control,” demonstrating that AI integration can be achieved without diminishing the teacher’s authority as the guardian of aqidah (faith) and akhlak (morals) in the learning process. From a practical perspective, the study provides empirical evidence that Canva AI can effectively address longstanding challenges in Islamic Religious Education instruction, such as the abstract nature of the material, low student interest, and teachers’ limited preparation time. These advantages are delivered at low cost and can be widely replicated in schools and madrasahs throughout Indonesia. At the policy level, the research findings offer data-driven recommendations that relevant ministries can utilize to formulate national guidelines for the use of generative AI in Islamic Religious Education teaching and learning. Methodologically, the study presents a qualitative case-study protocol that can be adopted by other researchers examining the integration of technology in religious education. Overall, this research affirms that AI holds tremendous potential to revitalize Islamic Religious Education instruction without displacing the teacher’s role as murabbi (educator of character) and mu’allim (transmitter of knowledge), making it highly relevant to the advancement of Islamic education in the digital era

## E. RECOMMENDATIONS FOR FUTURE RESEARCH DIRECTIONS

Future research directions could focus on the development and testing of the “Blended Islamic Religious Education-AI with Islamic Content Control” model across more diverse educational levels and AI platforms. Longitudinal studies are needed to evaluate the long-term impact of AI-generated visuals on the formation of students’ Islamic character. Investigations into the ethical and theological dimensions of Islam concerning the use of generative AI are also essential, particularly regarding Sharia boundaries, the accuracy of religious evidence (dalil), and the potential for algorithmic bias. Subsequent studies could develop official Canva AI modules aligned with the Kurikulum Merdeka and compare their effectiveness with other AI tools. Additionally, research is required on Islamic Religious Education teachers’ AI literacy, the integration of AR/VR in Islamic education, and the implementation of these technologies in 3T regions (frontier, outermost, and least developed areas) to ensure the inclusivity of Islamic religious education.

## E. CONCLUSION

This research successfully demonstrates that the integration of artificial intelligence through the Canva application can transform the design of Islamic Religious Education instruction at the junior high school level from a conventional approach often perceived as monotonous to a more adaptive, personalized, and efficient model, without compromising the teacher’s role as the guardian of the accuracy of aqidah (faith) and akhlak (morals). By leveraging Magic Studio features, design personalization, and automation, Islamic Religious Education teachers are able to produce contextually relevant and aesthetically engaging visual media, thereby enriching the learning experience of students who have long been confined to verbal-memorization methods. This innovation broadens the horizons of Islamic education scholarship by affirming that generative technology is not a substitute for da’wah but rather

a modern medium (wasilah) that strengthens the principle of inviting others to the path of Allah with wisdom and beautiful preaching, as enshrined in Q.S. An-Nahl: 125.

The developed implementation strategy, structured blended learning with rigorous Islamic content control, encompassing the SIKAP model, mandatory Student Worksheets (LKPd), compulsory content review, and dialogic facilitation, produces a prudent approach fully aligned with Islamic values. In this framework, AI serves merely as a servant of the creative process, while the teacher remains the murabbi who ensures that every visual and narrative aligns with the official curriculum and authentic Islamic sources. This approach represents a significant advancement of blended learning and TPACK theories in the context of religious education, incorporating the additional dimensions of Sharia ethics and "human-in-the-loop" as the primary filter against potential misconceptions arising from AI outputs. Thus, the study offers a realistic, replicable model for thousands of schools and madrasahs across Indonesia seeking to modernize Islamic Religious Education without sacrificing its spiritual essence.

The primary implications for Islamic Religious Education learning outcomes include the creation of instruction that is far more relevant to the digital generation: abstract concepts become concrete, intrinsic motivation surges, and both teacher and student time efficiency increases dramatically, all while opening greater space for deeper contemplation and spiritual reflection. To optimize this potential, educational institutions are urged to promptly upgrade basic digital infrastructure, conduct specialized training in prompt literacy and AI ethics for Islamic Religious Education teachers, and develop national guidelines for the use of generative AI in Islamic religious education. Such measures will enable similar innovations to be adopted more widely, safely, and meaningfully throughout the country.

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## AUTHOR CONTRIBUTIONS STATEMENT

All authors have made substantial contributions to the preparation of this article. HM: Conceptualization, Methodology, Formal analysis, Writing - Original Draft,. AD: Conceptualization, Data Curation, Writing - Review & Editing. AH: Conceptualization, Writing - Review & Editing. MAD: Conceptualization, Writing - Review & Editing. AY: Conceptualization,

## DECLARATION OF COMPETING INTEREST

The authors declare that there is \*no conflict of interest, financial, professional, or personal that could influence the process, results, or interpretation of this research. All research activities, data analysis, and manuscript preparation were conducted independently without any intervention from parties with vested interests in the study findings

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