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Immersive Virtual Reality for Teaching Stories of the Qur'an to Pre-Service Islamic Education Teachers: Design and Expert Validation of a Medium Developed with the Holistic 4D Model

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Abstract

Teaching the stories of the Qur'an in the teacher professional education programme (PPG) for Islamic Religious Education (PAI) often remains narrative–verbal and focused on information transfer, although these stories are meant to build character and moral reflection. Virtual reality (VR) offers immersive learning, yet development studies of VR for Qur'anic stories in the PPG PAI context are scarce. This article reports a development study that asks how an immersive VR medium for teaching Qur'anic stories can be designed for PPG teachers and how feasible experts judge it to be. Following the Holistic 4D model (Define, Design, Develop, Deploy) with a sequential mixed-methods design, the Define stage combined literature review, analysis of curriculum and teaching materials and a SWOT analysis into a system requirement specification and four development principles, including the principle of not depicting prophets and messengers. The Design stage produced a storyboard, user flow, menu structure, interface blueprint and an animated video of Surah al-Fil (Q 105:1–5) as prototype content. Three experts rated the medium at 95% (PAI content), 90% (media) and 90% (learning technology), a mean of 91.67%, categorised as very valid. The field trial of the Deploy stage has not been conducted, so no effectiveness is claimed. The findings are a basis for the next development and trial stages.

Keywords Virtual reality; Immersive learning; Qur'anic stories; Islamic religious education; Holistic 4D model

مستخلص البحث

تتناول هذه الورقة تطوير وسيط تعليمي غامر قائم على الواقع الافتراضي لتعليم قصص القرآن الكريم لطلاب برنامج تأهيل المعلمين المحترفين (PPG) في مادة التربية الدينية الإسلامية. ينطلق البحث من أن تعليم قصص القرآن ما زال يغلب عليه الطابع السردي اللفظي ونقل المعلومات، مع أن هذه القصص تهدف إلى بناء الشخصية وترسيخ القيم، ومن أن الدراسات التطويرية في هذا المجال محدودة. اعتمد البحث نموذج 4D الشمولي (التعريف، التصميم، التطوير، النشر) بتصميم مختلط متتابع. أسفرت مرحلة التعريف عن مواصفات النظام وأربعة مبادئ للتطوير، منها عدم تصوير الأنبياء والرسل، وأسفرت مرحلة التصميم عن لوحة قصصية ومخطط للتنقل وبنية القوائم وتصميم الواجهة وفيلم رسوم متحركة لسورة الفيل (الآيات 1–5) بوصفه محتوى أوليًا. وقد قيّم ثلاثة خبراء الوسيط بنسبة 95% في المادة و90% في الوسائط و90% في تكنولوجيا التعلم، بمتوسط 91.67% ضمن فئة «صالح جدًا». ولم تُجرَ بعد التجربة الميدانية في مرحلة النشر، ولذلك لا تدّعي الورقة فاعلية الوسيط، وتبقى النتائج أساسًا لمراحل التطوير والتجريب اللاحقة.

كلمات أساسية الواقع الافتراضي؛ التعلم الغامر؛ قصص القرآن؛ التربية الدينية الإسلامية؛ نموذج 4D الشمولي

1. Introduction

1.1. Background and significance

Teaching Islamic Religious Education (PAI) in the teacher professional education programme (PPG) faces epistemological and pedagogical challenges that are not simple, especially when the material consists of stories of the Qur'an (Ghufron et al., 2023; Nurgenti et al., 2025). On the one hand, the PAI curriculum is designed to form pedagogical, professional, social and personality competencies, including the ability to convey Qur'anic values contextually and transformatively (Sugiana, 2019; Syam, 2019). On the other hand, classroom practice tends to remain narrative–verbal, textual and oriented to information transfer. It seldom offers learning experiences that are reflective, imaginative and meaningful for learners.

Qur'anic stories carry a strong pedagogical dimension: they build character and instil *tawhid*, exemplary conduct, moral steadfastness and historical–spiritual awareness (Latif, 2021; Rosita, 2016). In practice, however, a story is often told only as chronology (who, when, where). It does not reach the dimension of experiential learning in which learners 'experience' the meaning of the story. Internalisation of values then becomes cognitive and informative rather than affective and transformational.

The challenge is sharper for digital-native learners who grow up in a visual, interactive and multimodal culture. They are used to immersive, participatory and experience-based learning environments. When PAI lessons still rely on one-way lectures and two-dimensional media, the learners' characteristics and the lesson design fall out of step, with consequences for engagement, intrinsic motivation and the depth of reflection on values.

Virtual reality (VR) offers an opportunity here. VR creates a three-dimensional learning environment that simulates spaces and events, so that learners can feel a sense of presence inside a narrative event. Unlike conventional media, VR can reconstruct the historical context, social setting and emotional dynamics of a Qur'anic story in a more vivid and reflective way, provided that the Islamic principles of creed and of representation are respected. Studies of VR-based immersive learning report gains in knowledge retention, empathy, emotional involvement and transfer of values in narrative learning (Liagkou et al., 2019; Pramesti et al., 2022; Sanchez et al., 2000; Sukmawati et al., 2022).

1.2. Previous scholarship

Three strands of scholarship frame the problem. The first concerns Qur'anic stories and character formation in PAI. Rosita (2016) examined the story method for shaping students' character, and Latif (2021) developed a story-based PAI method for inculcating Islamic character. Nurgenti et al. (2025) discussed professional PAI teachers grounded in Qur'anic values, Sugiana (2019) and Syam (2019) addressed PAI curriculum development and the teacher's role, and Ghufron et al. (2023) described changes in learning modality in the digital era.

The second strand is research on VR and immersive learning. Sanchez et al. (2000) analysed the design of VR systems for education from a cognitive approach, and Liagkou et al. (2019) described the realisation of a VR learning environment. Sukmawati et al. (2022) and Pramesti et al. (2022) discuss VR as an alternative learning medium. The wider discussion of the metaverse maps its taxonomy, components and open challenges (Park & Kim, 2022), considers virtual worlds as spaces for performance (Baía Reis & Ashmore, 2022) and discusses bodies in these spaces (Hesselbein & Bory, 2025).

The third strand is immersive technology in PAI. Dimyati (2025) explored the metaverse as a virtual medium for strengthening spiritual values, Hartati (2025) and Lutfiah (2024) analysed the potential and challenges of augmented reality in PAI, and Hakim and Syawaludin (2025) discussed VR for the effectiveness of PAI lessons in schools. These studies show growing attention, but most remain conceptual, descriptive or limited trials.

1.3. Gap and distinct contribution

Each strand, taken alone, leaves a gap. Research on Qur'anic stories rarely addresses immersive media. VR research seldom addresses the Islamic principles of representation. Studies of immersive technology in PAI have mostly not moved to systematic development based on the pedagogical needs of PPG teachers and on standardised technical specifications. The gap has three aspects. Pedagogically, a model is needed that combines the narrative–reflective approach with immersive experience, so that spiritual values are lived and not only understood. Professionally, PPG PAI teachers need preparation to develop and use innovative immersive media that fit the profile of a professional teacher in the digital era. Academically, research is needed on VR design based on Islamic values that is pedagogically structured and empirically tested. The distinct contribution of this article is a documented development path, from needs analysis through design to expert validation, for a VR medium that teaches Qur'anic stories to PPG PAI teachers.

1.4. Research objective and contribution

The objective is to describe the design of an immersive VR medium for teaching Qur'anic stories in the PPG PAI course and to examine its feasibility through expert validation. The contribution is fourfold: (a) a system requirement specification and four development principles, including a principle of representation ethics (Tables 1 and 2); (b) a design blueprint and prototype content in the form of an animated video of Surah al-Fil (Figures 2 and 3); (c) expert validation evidence (Table 3); and (d) an explicit agenda for the Deploy stage.

1.5. Research questions and article organization

Research questions: (RQ1) How can an immersive VR medium for teaching Qur'anic stories to PPG PAI teachers be designed? (RQ2) How feasible is the medium according to expert validation?

Section 2 explains the development method and the status of the data. Section 3 presents the results of the Define and Design stages and the expert validation. Section 4 discusses the findings, Section 5 states strengths, limits and research integrity, and Section 6 concludes.

2. Methods

2.1. Development design

This study adapts the Holistic 4D development model (Define, Design, Develop and Deploy) developed by Reigeluth (2023) and introduced three years earlier by Reigeluth and An (2020). The model was chosen because it integrates formative design and suits development research in education, and because it joins learner-centred learning theory with instructional design (Roman, 2022). The study uses a sequential mixed-methods design that combines quantitative, qualitative and experimental approaches in four complementary stages: exploration of needs (Define), development and formative validation (Design and Develop), and a test of effectiveness through a quasi-experiment in the Deploy stage. Figure 1 shows the procedure and the status of each stage.

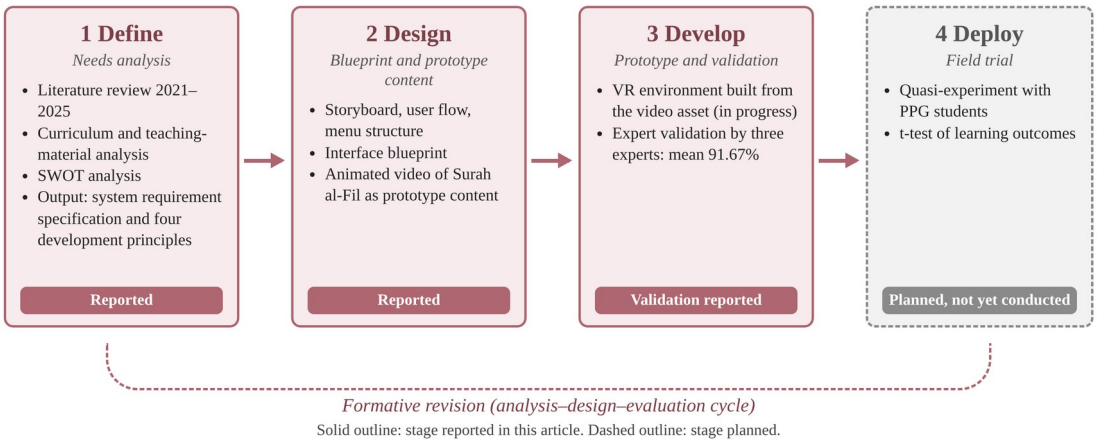


Figure 1. Holistic 4D procedure adapted in this study and the status of each stage. Solid outlines mark stages reported here; the dashed outline marks a planned stage.

2.2. Define stage

In the Define stage the team identified and analysed needs and data in order to formulate the initial system specification. The analysis covered (a) the problems of PAI learning in the digital era, particularly the progress of VR; (b) the content and learning scenarios suitable for simulation in a VR environment; (c) the readiness and choice of adaptive technology; and (d) indicators and criteria for selecting the location and subjects, based on pedagogical readiness and digital infrastructure. The result was a system requirement specification (SRS) that became the basis for prototype design.

The literature reviewed covered research from 2021 to 2025 on PAI, VR and computer-assisted language learning. The protocol also included survey questionnaires, observation and interviews; this article reports the outcomes of the literature review, the analysis of curriculum documents and teaching materials, and the SWOT synthesis. Qualitative data were analysed descriptively and numerical data with descriptive statistics.

2.3. Design stage

In the Design stage the team translated the needs analysis into a conceptual and technical design, a prototype design blueprint. The design covered (1) the system architecture and VR integration, (2) the user flow in the immersive environment, (3) the modules and scenarios of PAI learning, (4) the learning evaluation instrument and (5) the blueprint of display and navigation. The stage applies an iterative analysis–design–evaluation (ADE) cycle to keep pedagogy and technology aligned, with attention to experiential learning, immersive learning and VR interaction. An initial conceptual expert review of the design (a paper review) took place before development.

2.4. Develop stage and expert validation

In the Develop stage the conceptual design is realised as a prototype VR system for PAI learning. Its focus is the development of the prototype, the content and modules of Qur'anic stories, the interface, navigation and VR back end, expert validation of the beta product, and internal revision. Three experts validated the medium: a PAI content expert, a media expert and a learning-technology expert. The validation addresses the feasibility of content, learning design, display, ease of use and suitability of the technology. Scores were converted to percentages and categorised with a Likert-scale conversion adapted from Arikunto et al. (2023).

2.5. Deploy stage and status of the data

The Deploy stage applies and tests the product with PPG students of the Graduate School of Universitas Negeri Malang in a field trial with a quasi-experimental design, analysed with a t-test. This stage has not been carried out. The article therefore reports no learner data and makes no claim about learning effectiveness. The outputs of the Define and Design stages are products of the development process, and the validation scores are expert judgements, not learner outcomes.

3. Results

3.1. Define: needs analysis and system specification

The Define activities comprised (1) a literature review on VR, immersive learning, PAI and the learning of Qur'anic stories; (2) analysis of curriculum documents and teaching materials of PPG PAI; (3) identification of the characteristics of Qur'anic story material that can be developed into immersive media; and (4) drafting of the SRS as the basis for the prototype. From the data obtained, the team carried out a SWOT analysis (Table 1).

Table 1. SWOT analysis for the development of a VR medium for Qur'anic stories

Aspect	Findings
Strengths	Contextual and based on local culture; integration of several immersive technologies; support from learning theory; response to community needs; references from earlier studies
Weaknesses	Few earlier innovations; high complexity of the technology; few specific studies; possible user resistance
Opportunities	Growing need for innovative media; strengthening of local wisdom at the global level; support of the digital era; cross-disciplinary collaboration
Threats	Limited access to technology; sustainability challenges; competition with global media; cultural-sensitivity issues

Table 1 summarises the team's own analysis of the data obtained in the Define stage.

The literature review of publications from 2021 to 2025 gave three main findings. First, research on VR in education has increased significantly and reports gains in learning motivation, learner engagement, knowledge retention and authentic learning experience, but implementation in PAI, especially for stories of the Qur'an, is still very limited. Second, the learning of Qur'anic stories in schools is still dominated by lectures, presentations and two-dimensional video. These are effective for conveying information but do not yet give reflective, contextual and emotional experience, although Qur'anic stories function as a medium for internalising values, forming character and strengthening spirituality. Third, the needs identification shows that PPG teachers need a medium that is easy to use, matches PAI learning outcomes, increases learner engagement and respects the principles of creed and representation in Islam.

These findings shaped the initial specification in Table 2. The medium is a VR application for Android that runs on a head-mounted display (HMD), for PPG PAI students and PAI teachers. It follows a narrative immersive-learning approach, so that users gain experience by exploring a virtual environment and not only information about the story.

Table 2. Summary of the initial specification of the VR medium

Component	Specification
Platform	Virtual reality application for Android
Device	Head-mounted display (HMD)
Target users	PPG PAI students and PAI teachers
Approach	Narrative immersive learning
Features	Interactive navigation, audio narration, information hotspots, learning reflection and experience-based evaluation

The study also fixed four development principles: (1) no visual representation of prophets and messengers; (2) visualisation of the environment, objects and atmosphere of the event in line with the rules of Islamic education; (3) priority for reflective learning over entertainment; and (4) integration of PAI learning objectives with VR technology.

3.2. Design: blueprint and prototype content

The Design stage produced the conceptual design for the prototype: a learning storyboard, a user flow, the menu structure of the application, a user interface blueprint and immersive-learning scenarios. The blueprint has seven main menus: opening page, instructions for use, selection of a Qur'anic story, exploration of the virtual environment, presentation of learning values, reflection, and evaluation of learning. The design links pedagogy, user experience and ease of implementation in PPG PAI teaching.

The stage also produced the first multimedia content, an animated video of Surah al-Fil, as prototype material for the VR medium. The video follows Q 105:1–5: the attack on the Ka'ba by the army with elephants led by Abrahah, the destruction of that army by flocks of birds (Ababil) carrying stones of baked clay, and the affirmation of God's power in protecting the Sacred House. The visualisation reconstructs environment, objects and atmosphere of the event and does not show figures whose depiction would conflict with the principles of creed and representation in Islam.

The video was produced in several steps: scripting from tafsir sources and PAI teaching references, storyboarding, design of visual assets and environment, animation, narration, background music, sound effects and final editing. It follows a learning flow of introduction, telling of the story, reinforcement of the values in Surah al-Fil and reflection. Figures 2 and 3 show the rough-sketch and colouring stages of two scenes.

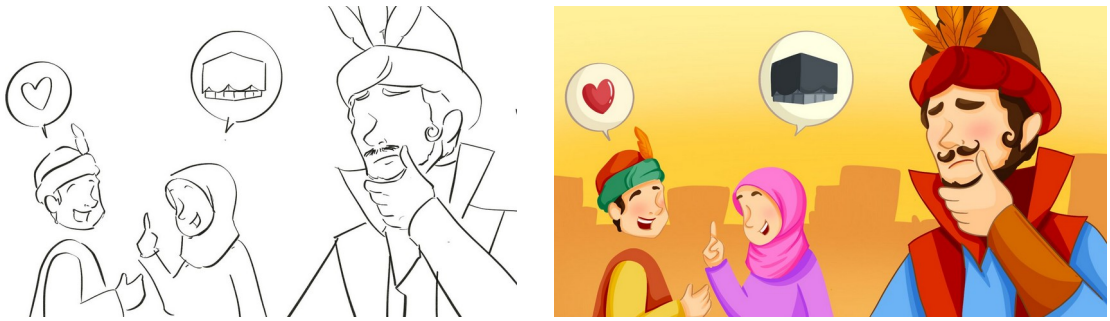


Figure 2. Rough sketch (left) and colouring (right) of a dialogue scene in the Surah al-Fil animation.



Figure 3. Rough sketch (left) and colouring (right) of the scene of the elephant and the Ka'ba.

The video is both a stand-alone learning resource and the main multimedia asset for building the three-dimensional virtual environment. At the time of writing the video is complete and its conversion into VR is under way. The next step integrates three-dimensional objects, user navigation, spatial audio, interaction in the virtual environment and reflection features.

3.3. Expert validation

Table 3 shows the results of expert validation. The PAI content expert gave 95%, the media expert 90% and the learning-technology expert 90%. The mean is 91.67%, and all three scores fall in the 'very valid' category.

Table 3. Results of expert validation of the VR medium

Validator	Score (%)	Category
PAI content expert	95.00	Very valid
Media expert	90.00	Very valid
Learning-technology expert	90.00	Very valid
Mean	**91.67**	**Very valid**

Scores are expert judgements converted to percentages. Item-level scores are not reported here.

3.4. Status of the Deploy stage

The field trial of the Deploy stage has not been conducted. Accordingly, no results on learning outcomes, engagement or internalisation of values are available, and none are inferred from the validation scores.

4. Discussion

4.1. The need for an immersive medium for Qur'anic stories

The Define finding that Qur'anic stories are still taught mainly through lectures, presentations and two-dimensional video matches the problem set out in the Introduction: a narrative–verbal tendency and a focus on information transfer (Ghufron et al., 2023; Nurgenti et al., 2025). Because Qur'anic stories serve character formation and the inculcation of values (Latif, 2021; Rosita, 2016), a medium that only conveys the chronology is not enough. The PPG teachers' need for a medium that is easy to use, fits learning outcomes and raises engagement suggests that the added value of VR lies in providing experience and not only visualisation.

The finding that VR in PAI is still very limited agrees with earlier studies that are mostly conceptual, descriptive or small in scale (Dimyati, 2025; Hakim & Syawaludin, 2025; Hartati, 2025; Lutfiah, 2024). The specification from the Define stage therefore fills the gap between the much-discussed

potential of the technology and the pedagogical needs of PPG PAI teachers, which had not been mapped systematically. The SWOT results point the same way: the strengths lie in context, theoretical support and response to needs, while the weaknesses and threats concern technological complexity, possible user resistance and limited access to technology. These are challenges to be managed in the Develop and Deploy stages.

4.2. Representation ethics as a design principle

This study treats the Islamic principle of representation as a design principle and not as a later addition. Two of the four development principles, no visual representation of prophets and messengers and visualisation of environment, objects and atmosphere, shape design decisions directly. In the Surah al-Fil video the visualisation concentrates on the reconstruction of environment, objects and atmosphere of the event. Because virtual worlds are designed spaces of experience (Baía Reis & Ashmore, 2022; Park & Kim, 2022), what the environment shows and leaves out is a pedagogical and ethical decision. The approach shows that an immersive experience can be designed in line with the rules of Islamic education, and it responds to the cultural-sensitivity issue identified as a threat in the SWOT analysis.

4.3. Formative design and the video as a multimedia asset

The Holistic 4D model stresses formative design that adapts to learners' needs (Reigeluth, 2023; Reigeluth & An, 2020; Roman, 2022). The order of work in this study reflects that stance: needs were analysed first in the Define stage, translated into a blueprint in the Design stage and only then realised in the Develop stage. Completing the animated video first, as a multimedia asset, allows the story content to be examined and refined before it is integrated into a three-dimensional environment, which helps to contain the technological complexity noted in the SWOT analysis. The approach is consistent with the view that the design of VR systems for education should start from cognitive and pedagogical considerations (Sanchez et al., 2000).

4.4. Reading the expert validation

The mean of 91.67% shows that the experts judged the medium very valid in content, media and technology. The highest score came from the PAI content expert (95%), which indicates that the substance of the story material was judged strong, while the media expert and the learning-technology expert gave the same score (90%). This agrees with the formative-design stance of the 4D model, in which expert judgement is part of the development cycle before the field trial (Reigeluth, 2023; Reigeluth & An, 2020). Validation by three experts shows feasibility, not effectiveness: it says nothing about how learners respond.

4.5. Implications and cautions for the Deploy stage

For teacher education, the study suggests that PPG PAI teachers can be prepared to use immersive media for Qur'anic stories that follow stated principles of representation and include reflection and evaluation. For research, the Deploy stage should use a quasi-experimental design with a comparison group and should measure learning outcomes and, separately, engagement and reflection on values, because these are not the same variable. Practical cautions are the availability of HMD devices and the digital infrastructure of users, and possible user resistance, both of which appear in the SWOT analysis. Later publications should also report the validation instrument at item level.

5. Strengths, Limitations, and Research Integrity

The strengths of the article are a documented development path from needs analysis to expert validation, an explicit specification with stated development principles, and a clear separation between evidence of feasibility and evidence of effectiveness. The main limitations are as follows. The field trial has not been conducted, so effectiveness is not shown. Validation involved three experts and only overall scores are reported.

Regarding integrity, the authors report the expert scores as given and infer no learner outcomes from them. The sources are cited for the focus of their reported work, and readers should consult the full texts before relying on them for detail. The authors belong to the programme in which the medium is developed, so the study reflects a situated perspective that independent readers should examine.

6. Conclusion

An immersive VR medium for teaching stories of the Qur'an to PPG PAI teachers can be designed from a documented needs analysis. The Define stage produced a system requirement specification and four development principles, including the principle of not depicting prophets and messengers. The Design stage produced a storyboard, user flow, menu structure, interface blueprint and an animated video of Surah al-Fil as prototype content. Three experts rated the medium at 95%, 90% and 90% (mean 91.67%, very valid). These results show feasibility in content, media and technology. They do not show learning effectiveness, which needs the field trial of the Deploy stage. The next steps are to complete the VR environment from the animated video, refine it on the experts' input and test it with PPG PAI students in a quasi-experiment.

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