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Integrating Islamic Values into Technological Inquiry: A Study of Water-Saving Ablution Technologies

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ABSTRACT
Research on water-saving technologies for wudu increasingly considers religious, cultural, and practitioner aspects beyond technical efficiency. However, how Islamic moral commitments orient technological inquiry remains insufficiently articulated. A structured state-of-the-art review of 20 studies examines technological strategies, evidence of mediated action and perception, and Islamic values in research decisions. Findings show that Islamic non-excess or Prophetic moderation informs problem formulation in 60% of studies, yet only 5% explicitly articulate awareness-oriented research aims. Drawing on the philosophy of values in science and postphenomenology, the paper proposes Islamically oriented postphenomenological inquiry as a conceptual approach connecting moral commitments, technological mediation, and empirical justification. The approach guides researchers in determining which mediated practices warrant investigation and what evidence is appropriate for evaluating them, without inferring practitioners' niyyah (intention) from observable outcomes.
Keywords: *Islamic worldview; Postphenomenology; Technological mediation; Scientific inquiry; Wudu; Water conservation*

1. INTRODUCTION

Research on water-saving technologies for wudu has increasingly considered aspects beyond technical efficiency. Recent studies address ritual water coverage (Embong et al., 2023), cultural influences on water-tap design (Ghazali et al., 2023), and culturally informed consumption monitoring (Ghazali et al., 2024). Such developments demonstrate that religious, cultural, and practitioner considerations already inform technological research. Their inclusion raises a further question concerning how these considerations shape not only technological solutions but also what researchers seek to investigate and evaluate.

Islamic teachings give water use during wudu a moral significance extending beyond technological efficiency. The Qur'an cautions against excess (Qur'an 7:31), while Islamic environmental scholarship associates resource use with responsibility toward creation (Cam, 2025; Gade, 2019, 2023; Shaleh & Islam, 2024). Prophetic traditions describe ablution using a limited quantity of water, one mudd, and water drawn from a vessel (Sahih al-Bukhari 199, 201; Sahih Muslim 235a). Islamic teachings also emphasize niyyah (intention), as expressed in the principle that actions are judged according to intentions (Sahih al-Bukhari 1). In the present discussion, niyyah refers specifically to the intention to avoid excessive water use, rather than ritual validity. Water conservation therefore involves not only measurable consumption but also the moral significance of intentional moderation.

Translating Islamic commitments to non-excess into technological research introduces an epistemological tension. Engineering evaluations can establish whether a device reduces water consumption, but such outcomes do not necessarily explain how technologies mediate practitioners' engagement with conservation. Automated systems may reduce consumption without requiring conscious moderation, while direct practitioner control does not guarantee it. Although existing studies address technical performance, practitioner considerations, and Islamic values, their inclusion does not itself explain how moral commitments should inform the investigation of mediated practice or what evidence is appropriate for evaluating morally oriented research objectives. The research gap is

therefore conceptual and epistemological: how to relate Islamic moral orientation, technological mediation, and empirical justification within technological inquiry. Examining existing research provides a basis for understanding how these concerns are currently addressed before developing their philosophical relationship.

The philosophy of values in scientific inquiry provides a foundation for examining how moral commitments may guide research objectives and evaluation without replacing empirical justification (Douglas, 2009; Lacey, 1999). Postphenomenology complements this perspective by understanding technologies as mediators of human action and perception rather than neutral instruments (Ihde, 1990; Verbeek, 2005). Their combination enables a philosophical examination of how Islamic commitments orient technological inquiry, which practitioner–technology relations warrant investigation, and what evidence can justify conclusions about conservation and mediated experience without inferring practitioners' niyyah.

Accordingly, the paper asks: how are Islamic moral values incorporated into the development and evaluation of wudu water-saving technologies, and how might these values orient postphenomenological inquiry into technologically mediated practice? A structured state-of-the-art review of 20 studies examines technological strategies, evidence concerning mediated action and perception, and the integration of Islamic values across stages of inquiry. Building on these findings, the paper proposes Islamically oriented postphenomenological inquiry as a conceptual approach for relating Islamic moral commitments, technological mediation, and empirical justification.

2. VALUES IN SCIENTIFIC INQUIRY AND TECHNOLOGICAL MEDIATION

Developing water-saving technologies for wudu involves decisions about which objectives are worth pursuing. Islamic commitments to non-excess and responsibility provide a moral orientation for such decisions, including the possibility of supporting intentional moderation. The philosophy of values in science explains how moral commitments may legitimately influence scientific inquiry. Lacey (1999, 2003) distinguishes

the influence of values on research strategies from the empirical justification of scientific claims, while Douglas (2009) examines their role in scientific judgment. In engineering design, van de Poel (2013) further explains how values can be translated into norms and technological requirements. Islamic commitments may therefore inform problem formulation, research objectives, design requirements, and evaluation criteria without determining empirical conclusions.

Beyond defining research objectives, technological inquiry must consider which aspects of practice warrant investigation. Postphenomenology provides a perspective for examining how technologies mediate human action and perception (Ihde, 1990; Verbeek, 2005). Technologies may invite, inhibit, or delegate actions while amplifying or reducing aspects of perception. In wudu, different water-control arrangements may achieve conservation while shaping practitioner engagement in different ways. Islamic non-excess provides a moral reason to investigate such relations, particularly when technologies are intended to support intentional moderation. Although postphenomenology recognizes the moral significance of technological mediation (Verbeek, 2011; Waelbers, 2009), it does not independently specify Islamic commitments.

The philosophy of values in science and postphenomenology provide complementary perspectives on technological inquiry, but their relevance to existing wudu technology research cannot be established through philosophical reasoning alone. Studies may explicitly incorporate Islamic moral commitments into research decisions or provide evidence concerning mediated action and perception without necessarily articulating these relationships in philosophical terms. Examining the existing literature is therefore necessary to understand whether and how these concerns are addressed in technological research, rather than assuming their presence, absence, or integration.

Examining how moral commitments and technological mediation appear in existing research requires analytical parameters grounded in the theoretical perspectives. The philosophy of values in science informs the examination of Islamic commitments across

problem formulation, research aims, design requirements, and evaluation, while postphenomenology provides the distinction between mediated action and perception. Technological strategies are also characterized to establish the material arrangements through which conservation is pursued. Together, these parameters guide the state-of-the-art review and provide a basis for the subsequent philosophical synthesis of moral orientation, technological mediation, and empirical justification.

3. REVIEW STRATEGY AND ANALYTICAL PROCEDURE

3.1. Review Strategy and Study Selection

A structured state-of-the-art review employed a PRISMA-informed screening process. Publications from 2006–2026 were searched through Semantic Scholar via Publish or Perish using: `(wudu OR wudhu OR ablution) AND (water OR "water consumption" OR "water conservation" OR "water saving" OR "water efficiency")`

The search identified 534 records. After removing four duplicates, 530 records were screened, excluding 484. Of 46 reports sought for retrieval, two were unavailable, leaving 44 for full-text assessment. Eligibility required relevance to wudu, point-of-use water reduction, technological or material intervention or comparison, English full text, and sufficient intervention details. Following the exclusion of 24 reports, the final review comprised 20 studies published between 2009 and 2026..

3.2. Analytical Coding

The review employed three levels of analysis, with the published study as the unit of analysis. Coding was based on evidence explicitly reported in each study rather than inferred research intentions. First, technological characterization classified each study according to its primary water-control or delivery strategy: temporal control, quantitative control, delivery form, information and feedback, hybrid arrangements, or comparative investigations.

Second, technological mediation was examined through evidence concerning action and perception (Ihde, 1990; Verbeek, 2006). Action-related categories included washing

activities, control operation, reported interaction, and behavioural modelling, while perceptual categories included reported perceptions, monitoring preferences, feedback features, and evaluated responses. Evidence was classified as direct when based on practitioner observations or reports, and indirect when based on technical operation, behavioural models, or design features.

Third, research orientation examined how Islamic commitments informed problem formulation, research aims, design requirements, and evaluation (Lacey, 1999; Douglas, 2009; van de Poel, 2013). Coding required explicit connections between Islamic values and research decisions, distinguishing moral non-excess from ritual requirements, cultural preferences, and general sustainability concerns.

All 20 studies received one primary technological classification, while mediation and research-orientation categories were non-exclusive. Frequencies were calculated at the study level. Neither technological performance nor practitioner evidence was treated as proof of niyyah or moral responsibility, and direct evidence was not assumed to establish causal mediation. The findings were subsequently interpreted through the theoretical perspectives established in Section 2 to develop Islamically oriented postphenomenological inquiry as a conceptual approach.

4. REVIEW RESULT

4.1. Technological Strategies for Water Conservation

The 20 reviewed studies were classified by their primary water-control or delivery strategy. Temporal control was the largest category (45%), predominantly involving sensor-triggered systems (35%). Other approaches included flow attenuation, bounded-volume supply, mist delivery, monitoring, hybrid arrangements, and comparisons of different water-delivery systems (Table 1).

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Table 1. Technological Strategies for Water Conservation During Wudu

Primary strategy	Sub-strategy	n	Studies
Temporal control	Sensor-triggered delivery	7	Adriansyah Hulukati et al., 2019; Audu & Gulani, 2025; Besari et al., 2009; Imran et al., 2025; Ritzkal et al., 2023; Widyaningrum, 2020; Zainal Abidin & A. Aziz, 2024
	Self-closing tap	1	Yusof et al., 2020
	Hand-actuated intermittent	1	Trusaji et al., 2019
Quantitative control	Flow attenuation	3	Hasnol & Ahmad Zaharuddin, 2020; Wajid & Abid, 2026; Wajid & Eid Alluqmani, 2025
	Bounded-volume supply	1	Taib et al., 2018
Delivery form	Mist delivery	2	Embong et al., 2023; Hassan & Hamid, 2025
Information / feedback	Monitoring	1	Ghazali et al., 2024
Hybrid	Combined strategies	1	Ghazali et al., 2023
Comparative	Multiple arrangements	3	Al-Alawi et al., 2021; Al Alawi, et al., 2023; Zaied, 2017

Figure 1 illustrates five representative arrangements: sensor-triggered delivery (Besari et al., 2009), hand-actuated intermittent delivery (Trusaji et al., 2019), hybrid control (Ghazali et al., 2023), conventional delivery with flow monitoring (Al-Alawi et al., 2021), and bounded-volume supply (Mat Taib et al., 2018). These configurations demonstrate the

diversity of technical approaches, providing a basis for examining how conservation is mediated and evaluated.



Figure 1. (a) sensor-triggered automatic delivery (Besari et al., 2009)

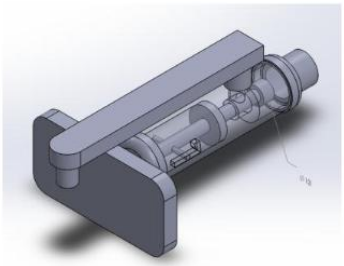


Figure 1. (b) hand-actuated intermittent delivery mechanism (Trusaji et al., 2019)



Figure 1. (c) hybrid water-control system (Ghazali et al., 2023)



Figure 1. (d) conventional manual tap fitted with a smart flow meter (Al-Alawi et al., 2021)



Figure 1. (e) bounded-volume supply system (Mat Taib et al., 2018)

4.2. Technological Mediation of Wudu Practice

The review examined evidence concerning how technologies mediate practitioner action and perception, distinguishing direct practitioner evidence from indirect technical evidence. Direct evidence includes observed actions and reported experiences, while indirect evidence concerns technological operation, behavioural models, and design features that may enable or constrain mediation. Table 2 summarizes these evidence types.

Table 2. Evidence types of technological mediation.

Dimension	Evidence examined	Evidence status	N
Action	Washing activities or timing	Direct observation	4
	Control mechanism operation	Indirect—technical	14
	Reported interaction or preferences	Direct—self-report	5
	Behavioural modelling	Indirect—modelled	2
Perception	Reported perceptions	Direct—self-report	2
	Monitoring preferences	Direct—self-report	2
	Visibility or feedback features	Indirect—design features	4
	Evaluated perceptual responses	Direct—evaluated responses	2

Note: Categories overlap and frequencies are based on coding of 20 studies

Indirect technical evidence was most prevalent, with 14 studies (70%) examining control-mechanism operation. Ghazali et al. (2023) provide a notable example of perceptual mediation through a transparent water tank intended to make consumption visible and encourage awareness. Although the design creates opportunities for perceptual engagement, its intended influence does not itself establish practitioners' reflective responses. In contrast, Al-Alawi et al. (2021) employed observations, water measurements, and interviews to investigate actual ablution practices and water management. These methods provide direct evidence of practitioner behaviour and reported attitudes, although

they do not necessarily establish responses to particular technological features or niyyah toward non-excess.

These findings demonstrate that technological capabilities, observed practices, and practitioner experiences constitute different forms of knowledge. Technical evidence identifies possible mediating conditions, while practitioner evidence provides insight into actual engagement. Neither independently establishes moral intention. Evaluating technological mediation therefore requires evidence appropriate to the particular practitioner–technology relationship being investigated.

4.3. Research Orientation and Evaluation

The review examined how Islamic moral commitments enter technological inquiry through problem formulation, research aims, design requirements, and evaluation (Table 3). Islamic non-excess or Prophetic moderation was explicitly invoked in the problem formulation of 12 studies (60%). However, only one study (5%) identified encouraging awareness of Islamic or Prophetic water moderation as an explicit research aim. Two studies (10%) translated Islamic considerations into identifiable technological requirements or performance targets, while seven (35%) used Prophetic water-use references to evaluate or interpret conservation outcomes.

Table 3. Integration of Islamic Values Across Stages of Technological Inquiry.

Stage of inquiry	Evidence examined	n (%)
Problem formulation	Islamic non-excess or Prophetic moderation explicitly invoked in framing water conservation	12 (60%)
Research aims	Explicit aim to encourage awareness of Islamic or Prophetic water moderation	1 (5%)
Design requirements	Islamic commitments inform identifiable technological requirements or performance targets	2 (10%)
Evaluation and interpretation	Prophetic water-use references employed to compare or interpret technological outcomes	7 (35%)

Note: Categories are non-exclusive

Hassan and Abdul Hamid (2025) provide a notable example of an explicitly Islamic awareness-oriented research aim. Beyond evaluating mist-spray efficiency, the authors identify fostering awareness of water wastage and encouraging adherence to Prophetic water use as an overarching purpose (p. 86). Their system incorporates LED indicators communicating water capacity, potentially making consumption more perceptible to practitioners. However, the empirical evaluation primarily examines water reduction, water coverage, and user comfort rather than whether these features encourage reflective engagement with non-excess. The study thus illustrates how Islamic moral commitments may inform technological purposes and design features without corresponding evidence of intentional moderation.

Other studies demonstrate different forms of value integration. Embong et al. (2023) incorporate Prophetic water-use references and Islamic requirements concerning ritual water coverage, while Wajid and Alluqmani (2025) employ Prophetic quantities as benchmarks for conservation. These approaches connect Islamic references with technological development or evaluation, but do not necessarily investigate practitioners' moral engagement. The findings therefore distinguish the presence of Islamic values in research from their translation into questions and evidence concerning technologically mediated practice.

4.4. Cross-Dimensional Synthesis

The findings distinguish three aspects of technological inquiry: conservation strategies, evidence concerning mediated practice, and the incorporation of Islamic values into research decisions. Technical evaluations are more prevalent than investigations of practitioner experience, while Islamic commitments appear more frequently in problem formulation than in research aims concerning conscious moderation. These patterns demonstrate differences in research attention, although the separate distributions do not establish how these concerns are integrated within individual studies.

Each aspect also supports different conclusions. Technical measurements and models establish or estimate conservation performance, while practitioner observations and reports provide evidence concerning mediated experience. Islamic values may orient research purposes and evaluation criteria, but neither technological outcomes nor practitioner responses independently establish niyyah toward non-excess. These distinctions raise a question concerning how moral commitments can inform which technologically mediated relations warrant investigation and what evidence is appropriate for evaluating them. This provides the basis for the philosophical synthesis developed in Section 5.

5. CONCLUSION

The review demonstrates that incorporating Islamic values into technological research does not necessarily establish how those values inform the investigation of technologically mediated practice. Islamic non-excess and Prophetic moderation appear in problem formulation in 60% of studies, yet only 5% explicitly articulate awareness-oriented research aims. Furthermore, technological capabilities, observed practices, and practitioner experiences provide different forms of evidence. Viewed through the philosophy of values in science and postphenomenology, the epistemological issue is therefore not the absence of moral considerations, but how moral orientation can guide the investigation of technological mediation while preserving empirical justification.

The paper proposes Islamically oriented postphenomenological inquiry as a conceptual approach connecting Islamic commitments with research objectives, the investigation of mediated practice, and appropriate evaluation methods. Islamic values inform which research objectives are morally significant, postphenomenology directs attention to mediated actions and perceptions relevant to those objectives, and empirical justification establishes the limits of research conclusions. The considerations are interconnected rather than a fixed sequence (Table 4).

Table 4. Application of Islamically Oriented Postphenomenological Inquiry

Consideration	Guiding question	Application in research and development
Islamic moral orientation	What moral commitments should guide the project?	Articulate Islamic values and translate them into research objectives and design considerations
Technological mediation	How might technology shape practices relevant to those commitments?	Examine how technological arrangements mediate practitioner action, perception, and opportunities for intentional engagement
Evidence and evaluation	What evidence is appropriate for evaluating the intended outcomes?	Investigate conservation performance and relevant practitioner experiences while distinguishing warranted conclusions from moral inferences

Adopting the proposed approach changes how researchers formulate and investigate technological problems. Rather than invoking Islamic non-excess solely to justify water reduction, researchers consider whether their objectives also concern practitioners' opportunities for intentional moderation. For example, a sensor-controlled ablution tap may be designed to reduce water consumption, but researchers may additionally investigate how automatic control shapes practitioner action and the perception of water use. Alternative arrangements, such as manual control or visible feedback, can then be considered according to the mediated experiences they are intended to support, without assuming any configuration is morally preferable.

The approach also informs how technological outcomes are evaluated and translated into subsequent design decisions. Water measurements can establish conservation performance, while observations and practitioner reports can provide evidence of how users interact with and experience technological arrangements. If encouraging conscious moderation is part of the research objective, investigating whether practitioners notice, interpret, and respond to water-control features becomes relevant. Such findings may guide design refinement, but neither reduced consumption nor practitioner responses independently establish niyyah.

Integrating an Islamic worldview into technological inquiry therefore involves more than incorporating moral values into technological objectives or interpreting conservation outcomes through religious references. Islamic commitments can also orient which mediated practices deserve investigation and what evidence is appropriate for evaluating the intended outcomes. *Islamically oriented postphenomenological inquiry* articulates this relationship as an epistemological orientation for researchers and engineers, rather than a new theory of mediation or a validated evaluation method. Its practical usefulness remains to be examined through future technological development and practitioner studies.

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