London Review of Education

LONDON REVIEW OF EDUCATION

UCLPRESS

Special issue: ***Culturally responsive STEAM education***

Research article

Islamic Scientific Critical Consciousness as a theoretical framework for Muslim science educators

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Submission date: 16 October 2023; Acceptance date: 27 February 2024; Publication date: 27 March 2024

How to cite
Mirza, U.J. (2024) 'Islamic Scientific Critical Consciousness as a theoretical framework for Muslim science educators'. *London Review of Education*, 22 (1), 9.
DOI: https://doi.org/10.14324/LRE.22.1.09.

Peer review
This article has been peer-reviewed through the journal's standard double-anonymous peer-review process, where both the reviewers and authors are anonymised during review.

Abstract

The suppression of Indigenous knowledge systems that accompanied the colonisation of Muslim lands from North Africa to the Asia-Pacific dismantled the Islamic science tradition, replacing it with a Western oppressive monoculture of secularised 'modern' science. Within this context, this article presents a theoretical framework for Muslim science educators, called Islamic Scientific Critical Consciousness. This framework aims to nurture Muslim students to develop the capacity to reinvigorate the Islamic science tradition by taking the positive elements of both the tradition and those of modern science. This entails the need for Muslim students to develop the critical consciousness to recognise colonial ideology being taught as 'objective' knowledge and the confidence and ethical orientation to pursue scientific research in harmony with an all-encompassing Islamic world view. This framework builds on Maldonado-Torres's framework of decoloniality by adapting it to consider the sources of oppressive ideologies from an Islamic perspective

in the monocultural school science classroom. The learning outcomes for this Islamic decolonial approach are then developed by integrating Paolo Freire's idea of critical consciousness with Muhammad Iqbal's idea of *Khudi* (selfhood). After building the theoretical framework, suggestions are made on how modern science education can be rethought in both multifaith and Islamic faith-based school settings.

Keywords science education; Islamic education; decolonising education; STEM education; STEAM education

Introduction

The aims of this framework

This article proposes a decolonial theory of science education within an Islamic paradigm. As many communities across the world have had their own characteristic experiences with colonialism, there is no one-size-fits-all approach towards emancipation from colonial legacies (Tuck and Yang, 2021). In this spirit, the article considers the case of Muslim science educators, within both Muslim countries and the diaspora in the West, at the secondary school level.

The problem that these Muslim educators face is that there is a paucity of contemporary educational theory, curriculum materials and pedagogical approaches set within an Islamic paradigm (which matters because of the desire to be coherent with their faith) that they can draw on to help their students tackle hegemonic colonial ideas that are often disseminated through traditional science education. In order to propose a theoretical framework that addresses this problem, I do not analyse any empirical data, but rather combine decolonial and Islamic educational theory to formulate educational aims and pedagogical principles, illustrated with examples, for Muslim science educators (secondary school teachers and curriculum designers).

Given that I am publishing this work while being situated in the West, where Muslim thinkers are always in danger of being mis-framed as being extremist in their thinking (Morey and Yaqin, 2011), it is worth explicitly stating that this endeavour does *not* aim to impose Islam on non-Muslims or to prevent students of any faith from critically thinking about their own beliefs. The Quran itself says, 'Let there be no compulsion in religion' (*Surah Al-Baqarah – 256*, n.d.). From the Islamic perspective, freedom of the soul from oppression and misguidance is won from complete submission to the commandments of Allah. This submission has to be entirely voluntary as an act of agency of the individual; it can never be externally imposed (Ahmed and Lawson, 2016).

Being situated in the West also means that my work runs the risk of coming across as a 'liberalising' or 'Westernising' agenda (Massad, 2015; Sahin, 2018), since in developing this theoretical framework, I also make use of non-Muslim thinkers. I want to highlight from the outset that a key strength of pre-colonial Muslim scholarship has been the ability to assimilate the intellectual work of non-Muslim thinkers from ancient Greece to South Asia (M. Iqbal, 2002; Saliba, 2007). This was done by critically evaluating and preserving those writings, and by taking that knowledge and putting it into discourse with Islamic beliefs (M. Iqbal, 2002; Saliba, 2007). It was this that allowed what is debatably referred to as a 'Golden Age' of Muslim intellectual thought, including in mathematics and medicine, to blossom, by learning with humility from others and building on top of it. Notably, during this Golden Age there was open debate and collaboration between scholars of all faiths (M. Iqbal, 2002; Saliba, 2007). This precedent was set from the time of the Prophet (PBUH), when students from all faiths were welcome to the mosques to study both religious and non-religious subjects (Niyozov and Memon, 2011).

It is also important to outline my own positionality as a decolonial scholar-activist. That is, I take an explicitly political standpoint in my academic work towards advocating a decolonisation of the relationship between science and religion in education within Islamic contexts. This particular motivation is directly shaped by my lived experiences: I grew up as a Sunni Muslim with a British-curriculum private school education in Pakistan, which inculcated within me notions of the West's inherent superiority and the idea that religion should be separate from the state. However, during my undergraduate study in physics and philosophy, my outlook changed as a result of what I learnt about philosophies of science

(for example, Feyerabend, 2010; A.M. Iqbal, 1934), 'modern' science's political economy and embedded coloniality (for example, Haq, 2017). Following a decade-long career in Pakistan as a teacher, curriculum designer and policy developer in science and pre-hospital care education, I continued to witness similar struggles that students undergo when they encounter what can be termed as 'ideological clashes' (Apple, 1971, 2004) between what is often deemed to be 'Western' scientific knowledge and practices and their Islamic beliefs (Sahin, 2018). In this context, where many terms such as 'revival' and 'de-Westernise' have become political buzzwords, I want to introduce a distinct theoretical framework that will help refocus on the helpful aspects of notions such as decolonisation, and help keep the eye on the ball, and that 'names the world' of a thematic universe (Freire, 2017) that resonates with Muslims globally.

An overview of colonial legacies for Muslims today

For centuries, the Indigenous knowledge systems of Muslim lands from North Africa to the Asia-Pacific were dismantled by European colonial powers (Kincheloe and Steinberg, 2004). This included systematic persecution of Muslim scholars, unravelling of Indigenous research institutions, and a gradual but firm imposition of 'Western' sensibilities, academic norms, European languages and intellectual thought through colonial-state controlled schooling (Kincheloe and Steinberg, 2004; Riaz, 2010). European empires branded their dominance a result of advancements in science (Evans, 2002). In particular, according to the grand narrative (Lyotard, 1979) of the European Enlightenment period, scientific and technological advancements were possible because academics and politics broke free of the shackles of religion. This systematic dismantling of knowledge systems, and the narrative perpetuation of European success being due to breaking free from religion, ultimately worked to inculcate a cultural inferiority complex and Eurocentrism in Muslims under colonial rule (M. Iqbal, 2002).

Given that science and religion are polysemantic terms with both historical baggage and much academic debate around their demarcation (Cobern, 1996; Taber, 2013; as illustrated in Table 1), I opt to use the term 'world views' in framing my theoretical framework. By world view (also a term with no consensus definition), I mean both 'visions of life' – such as epistemology and ontology – and 'ways of life' – such as moral frameworks, practices and transcendent experiences – for humans to live out their beliefs and values (Valk, 2009). In this sense, Abrahamic religions, for instance, are each a spectrum of world views, and so is science; for example, whether one believes in a God who creates and sustains everything in existence, or that the universe/multiverse simply 'is' and runs according to godless/secular physical laws. Within this framing, the impact of colonialism on the methods, norms and underlying philosophical assumptions of knowledge systems in the Muslim world lives on today, such as through international scientific research being embedded in assumptions of a secular world view (Santos, 2007).

Table 1. Salient problematisations of the terms 'religion' and 'science'

Broad area	Detail
	Religion
Beliefs are more than intellectualise-able dogma What beliefs count as religious	The distinction between how a religion may be known in general terms and the complexity of how it is interpreted, experienced and practised by individuals gets blurred by calling both the same 'religion' (Enstedt, 2020). There is a debate over whether beliefs such as New Atheism and Chinese beliefs about Yin and Yang (which may not involve any belief in deities) count as religions (Peterson, 2001).
	Science
Disagreement over metaphysical assumption	There is a debate over how much leeway there is in terms of the underlying assumptions one can hold about the nature of reality for the discourse to count as science; for example, is belief that the universe came into being by chance scientific or religious in nature (Taber, 2013)?

https://doi.org/10.14324/LRE.22.1.09

What counts as scientific theory and inquiry	What counts as science versus non-science remains an unresolved philosophical problem of demarcation (Hansson, 2021). Part of this is the faith versus evidence debate. Are scientific theories formed on the basis of conducting experiments still an act of 'faith' (as opposed to religious faith), or is there a different level of epistemic warrant for reliance on inductive reasoning and common a priori assumptions made in science, such as that the laws of motion hold the same everywhere in the universe and for all time (Feyerabend, 2010)?

As a result, today, for Muslims the world over, responding to the potential challenges to their faith and identity posed by this secular Eurocentric 'monoculture' of modern science (Santos, 2007) is an important concern (M. Iqbal, 2002; Malik, 2023), as illustrated in Table 2.

Table 2. Examples of potential challenges posed by Eurocentric monoculture (source: adapted from Malik, 2023)

Broad area	Example
Issues of epistemic authority	Does the success of modern science, and the domination of Muslim lands by Christian/secular European powers, indicate that Islamic knowledge should become secondary in prestige to secular scientific knowledge?
Issues of creed	Does the common modern biological assumption that humans have common ancestry with other life forms conflict with religious beliefs about God creating Adam and Eve (Malik, 2023)? (This is not to say that there is a consensus among Muslims and Muslim thinkers as to whether there are conflicts, and as to what those are.)
Issues of identity	Does studying primarily the accomplishments of White, Western scientists indicate their civilisational superiority (Park et al., 2023)?
Socio-religio-scientific issues (social issues that are sensitive to religious beliefs and practices of the concerned communities, and are also affected by both the medical and scientific practices and beliefs of those communities)	Does the use of secular psychological counselling services for mental wellness clash with belief in God's healing (N. Iqbal and Skinner, 2021)? This concern, for example, contributes to the hesitancy of many Pakistani Muslims in reaching out to secular mental health services in the midst of an ongoing mental health crisis (Yusuf, 2020).

The current problem for Muslim science educators

Given the aforementioned context that affects Muslims in modernity, hopes are pinned on education for the next generations that will help bring about a 'revival' in Muslim intellectual tradition. Revival in contemporary discourse about science commonly refers to bringing back the Islamic science tradition (M. Iqbal, 2002), with all its celebrated accomplishments, before the advent of colonisation of Muslim lands. In the Islamic science tradition, research was viewed as an act of worship, and the scientific discourse was embedded in an Islamic world view and ethical framework (M. Iqbal, 2002; Saliba, 2007). The natural sciences were considered a subject of *ilm* (knowledge) – and there was no formal compartmentalisation and distinction made between what today are called philosophy and science (M. Iqbal, 2002; Saliba, 2007). Also notable is that the pre-colonial Muslim schooling, from North Africa to Asia-Pacific, was decentralised (Daun and Arjmand, 2018): schools (*maktabs* and *madrasas*) did not teach a common uniform curriculum, and they were not regulated by a central board or department.

Regardless of whether the position is to 'bring back the past' or to 'build back better', there is much work to be done for contemporary Muslim science educators. The very abstract field of Islam and science has moved from debates about compatibility as a whole to domain-specific debates, including Islamic views on scientific paradigms such as Adamic evolution (Malik, 2023) and challenges to the idea of free will posed by quantum theory (Guessoum, 2010). Some common stopgap approaches for discussion that Muslim science educators at the university level are currently using, and the challenges they face, are illustrated in Table 3.

Table 3. Three approaches to countering colonial hegemony in science education for Muslims

Approach	Example	Challenge
Teaching the internal limitations of theories themselves	Identifying gaps in fossil records to make the case that the evidence of humans descending from apes is inconclusive (Elshakry, 2013; Qunaybi, 2023).	This approach runs into the challenge that it leaves open the possibility that the picture of reality being suggested by the theory (that is potentially challenging the religious world view) may still be true – maybe over time the evidence will grow stronger, even if now it can still be dismissed as inconclusive.
Teaching about the nature of science	This is so that students may appreciate that even seemingly certain scientific world views may be upended by paradigm shifts (S. Ahmed, n.d.).	Such lines of argument may also run into challenges, such as that the level of philosophical sophistication required to understand the nature of science arguments may be considered beyond the intellectual training and capacity of school students and the general public.
Teaching students about theology	By students appreciating the theology they align to in terms of: (1) the nature of God; (2) the nature of creation; and (3) the relationship between God and creation, they can then better assess whether a world view such as Adamic evolution is in conflict or confluence with their religious beliefs (Malik, 2023).	This approach runs into the challenge that most students may not be aligned with any particular theological subschool of thought within Islam.

Beyond this kind of high-level theoretical discourse, there is scant tangible literature (Mustafa, 2021) that has emerged that could be accessed or envisioned as a curricular and pedagogical approach for school educators – especially at the secondary school level. Table 4 illustrates some initiatives that are gaining traction for school educators at the primary and middle school levels.

From Table 4 it is evident that there is currently no publicly available and widely recognised pedagogical approach for Muslim educators working with high school students. To begin addressing this need gap, much inspiration can be taken from literature in multifaith secular society teaching contexts, and putting it in dialogue with Islamic principles. I will do this later in this article, but here it is important to emphasise this need for Muslim students at high school level, as these are the formative years in which they begin to study the sciences with rigour and as separate disciplines (usually biology, physics and chemistry). Hence, this is the stage at which students are substantially exposed to uncritically presented ideas that potentially conflict with Islamic world views, as illustrated by the dilemmas in Table 2 (a problem that resonates with students of other faiths too). These hidden curricula (Apple, 1971) can have formative bearing on the world views formed by students regarding science and religion. This matters not only

because it may result in loss of faith due to hegemonic narrative exposure in schools, but also because a lack of connection between one's faith/culture and science education may reduce the motivation for engagement with science (Emdin, 2010; Ladson-Billings, 1995).

Table 4. Teaching approaches specific to science and Islam that have tangible resources for educators

Name	Key thinkers	Relevant sources	Student age	Detail
5D Thinking	Necati Aydin, Alparslan Acikgenc, Nadine Kamal, Yamina Bouguenaya	5D Thinking (n.d.)	6–10 years	The 5D Thinking approach is based on the work of Ottoman scholar Syed Nursi, and it has been adapted to help teachers of Abrahamic faiths (especially Islam) connect their study of science with a sense of wonder at Allah's creations, and with religious morality. The developers of this approach have created publicly accessible lesson plans to help educators appreciate how they can translate theory into practice.
Concentric Circles	Elma Ruth Harder and Muzaffar Iqbal	Harder (2006)	5–6 years	This book provides concrete pedagogical examples of how Muslim educators working with students in primary school can help students connect their learning and play with an Islamic world view and values.
Holistic Science Teaching	Nidhal Guessoum, Athar Osama	Holistic Science Teaching Workshop & Fellowship – Pakistan Innovation Foundation (n.d.)	8–13 years	This is an initiative to train schoolteachers in teaching science 'holistically' by integrating teaching of the history, philosophy and Islamic religious connections to science. Currently it is being piloted in several Global South Muslim-majority countries.

Framing the theoretical problem

As illustrated, there is little literature within an Islamic paradigm that is accessible and tangible for on-the-ground Muslim educators at the secondary school level that can cater to the realities of teaching in multifaith contexts, and often with Muslims who do not know their own theological orientations or whose orientations may be from different Islamic sects. Any endeavour that seeks to meet these needs must blend: '(i) the theory coming from Islamic traditions; (ii) the empirical findings of the educational experiences of Muslim students in faith-based and secular schools; and (iii) the best ideas coming from the theory and practice of non-Muslim scholarship on education' (Niyozov and Memon, 2011: 25).

I will now attempt to make a first step towards addressing these questions by developing an educational theoretical framework. This framework is ultimately concerned with educational aims in today's real world (which is a non-ideal setting), where Muslims educators have to face the practical challenges and constraints imposed by coloniality. This is opposed to trying to first find a solution to unresolved debates in the relationship between Islam and science, and then attempting to consider

what education may look like in a utopian setting without sociopolitical constraints (in this sense, I am taking a philosophically pragmatic approach).

The theoretical aims of science education, which take into consideration the reality of coloniality, need to be framed by first expressing the 'problem' in Islamic terms. To do this, I reconceptualise Maldonado-Torres's (2016) specific notion of coloniality in terms of the Islamic idea of *fitna*. Maldonado-Torres (2016) posits that even though in many parts of the world today direct state control through settlers and exploitation colonialism has ended – in the sense that many countries have been formed after gaining formal independence from European powers –, there still remains a perpetual matrix of domination and control. This matrix continues to have profound lasting effects across formerly directly colonised communities. Maldonado-Torres (2016) builds on the ideas of seminal Global South scholars – such as Fanon, Quijano and Escobar – to describe this matrix of control, or, in other words, coloniality, in three different dimensions, as illustrated in Table 5.

Table 5. Maldonado-Torres's (2016) notion of coloniality

Dimension of coloniality	Meaning	Example
Coloniality of Power	The influence of colonial legacy over culture and structure.	The current centralised mass public school education systems in South Asia were introduced through British colonial endeavours in that area.
Coloniality of Knowledge	Control over what is considered 'objective' and 'relevant' knowledge, and over what are sound methodologies for its generation and understanding.	The 'modern' norm that the practice and learning of science should have nothing to do with religious beliefs.
Coloniality of Being	Control over conceptualisations of identity and self-esteem through warping particular sense of place in history and in global landscapes.	Lack of mention of non-White scientists in science textbooks in Pakistan inculcates Eurocentrism.

However, it is not coloniality per se, with its focus on various forms of systematic oppression, which will be central to a Muslim scientist, teacher or student; rather, for a Muslim, it will be the forces/trials/tribulations (which may be in the form of some kind of ease or hardship) – or *fitna* in Arabic-language Islamic discourse – that test the faith and the moral conduct of the believer (Al Hakim and Alam, 2019).

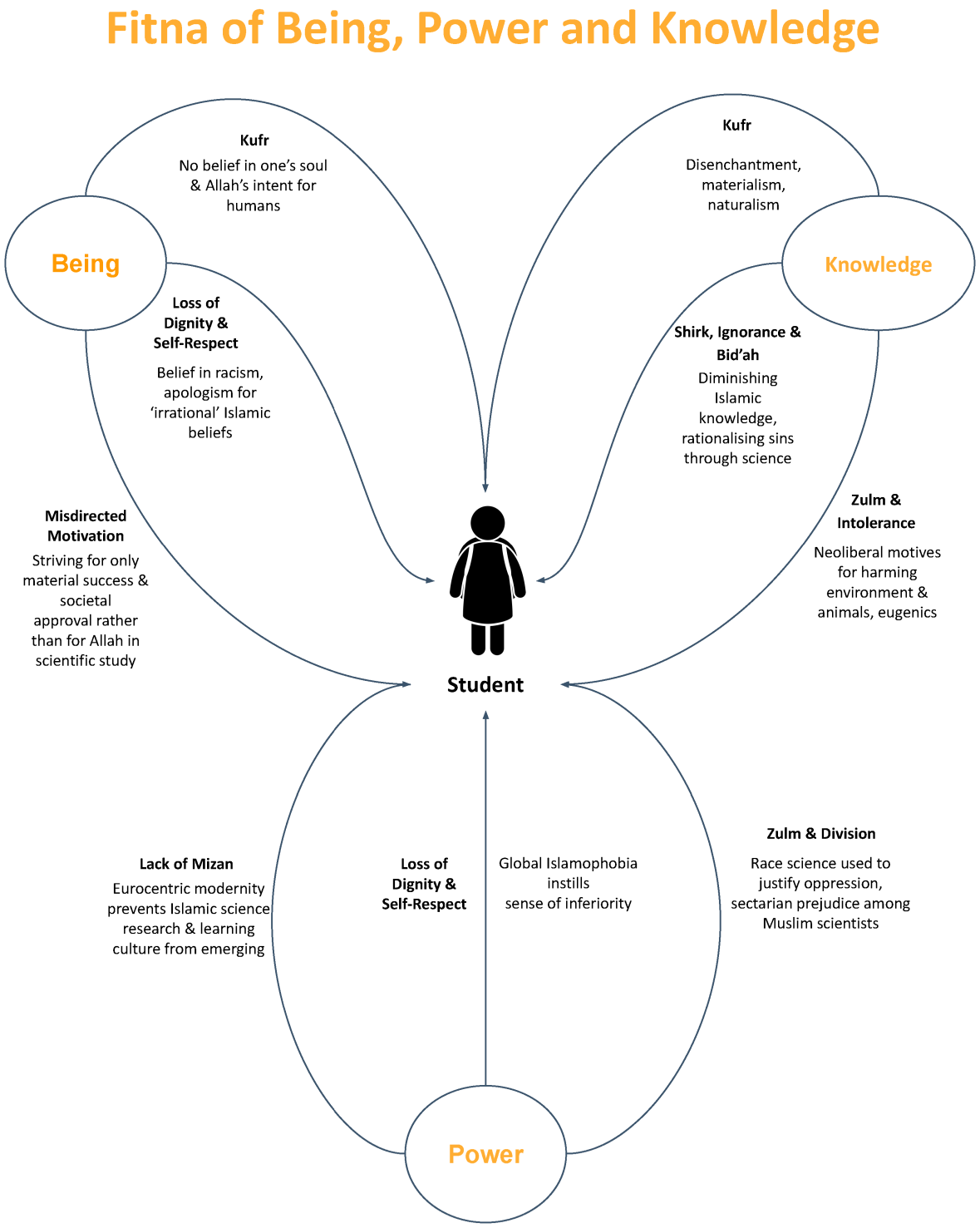
Analogous, then, to Coloniality of Knowledge, Power and Being are the *Fitna* of Knowledge, Power and Being. *Fitna* may stem from coloniality, or it may stem from internal dynamics within communities (for example, the development of a culture of hedonism, or despotic rulers rewriting what Islamic values mean according to their own desires), which may have nothing to do with the legacy of external oppressors; these are illustrated in Figure 1.

To elaborate on Figure 1, a Muslim's sense of Being ought to be grounded in their Knowledge that all humans have souls and that Allah created humans for a purpose. All humans are equal in the sight of Allah, except on the basis of their piety. So the motivation for pursuing a career in any field is not simply for one's material gain, but should always be considered as an act of worship to please Allah by doing one's job in the best way possible, with Islamic values and an intent to bring benefit to society.

Fitna of Being may occur, for example, when a Muslim student in the science classroom begins to believe that humans emerged on Earth without any role played by the Creator. Furthermore, loss of belief in the equality of all human beings would also be deviation from Islamic beliefs, such as by believing in eugenics or racial hierarchy through racism-embedded teaching of contemporary scientific theories (Nelson, 2016; Roberts, 2011; Saini, 2019), or through the seepage/import of White supremacist creationist arguments (Moore and Chung, 2005). Similarly a lack of belief in the moral purpose of the

creation of human beings may remove one ethical safeguard against rationalising human and animal rights abuses during scientific research.

Figure 1. Analytics of *fitna* in the context of modern science education from a Muslim perspective



Studying science through a secular epistemological and ontological lens may inculcate through a hidden curriculum the idea that Islamic knowledge and scientific knowledge are incompatible, or that Islamic

knowledge is superstition intended as an 'opium for the masses'. This would be the *Fitna* of Knowledge, and it is associated with the challenges in Table 2.

At a more macro level, the structure and norms of Eurocentric modernity contribute to a *Fitna* of Power. For example, the dominant prevalence of Eurocentric institutions, such as institutes of higher learning in science that operate using secular scientific discourse, prevent Islamic science research and learning culture from emerging. Furthermore, given the continued sociopolitical hegemony of Western countries over many of the countries they formerly directly colonised, the reach and influence of colonial Islamophobic messages can perpetuate a sense of cultural inferiority in Muslims. This can constrict the imagination (Greene, 2011) to conceive of studying and practising science with an Islamic world view.

The theoretical solution

The purpose of this theoretical framework is to address the significant need gap in curricular and pedagogical approaches to tackling, within an Islamic paradigm, the problems that secondary school Muslim educators and students face in the context of monocultural science education.

Building from the previous section, the *Fitna* of Being and Knowledge, within the science classroom context, boil down to two beliefs being inculcated in students that are problematic from an Islamic standpoint: the meaning of existence is socially constructed as an evolutionary response. There is no afterlife or soul; and the universe exists by chance, and runs according to mindless laws of physics.

For the Muslim science educator in the contemporary context, the aim becomes to counter the hegemony (Apple, 2004) of these two ideas that may lead to the *Fitna* of Knowledge and Being. However, to counter these hegemonic ideas, it is not enough just to intellectually dispel them. Rather, given how prevalently and pervasively through the *Fitna* of Power these ideas are ingrained in us through institutions and social norms in the monoculture of modern science, it is necessary to also instil within students a capacity to actively *resist* the influence of this monoculture.

To these ends, to frame the idea of Islamic Scientific Critical Consciousness (ISCC), I borrow certain ideas (not their complete frameworks) from Muhammad Iqbal (1934), a Muslim South Asian philosopher who wrote extensively on decolonising thinking about science and Islam, and from Paulo Freire (2017), a Brazilian education theorist known for his work on emancipatory pedagogical approaches.

From Freire, who is well known in Global North education discourse, I build on his general idea of critical consciousness (elaborated below) in the context of monocultural science (Lodge, 2021; Santos, 2007). However, within an Islamic world view, it is not enough to just consider the aims of decoloniality. Iqbal's ideas are powerful in making the transition to an Islamic conception of what critical consciousness is, especially since he brings into conversation both Western and Islamic philosophy in framing those ideas. Although Iqbal is less familiar to Global North audiences (although still relevant and drawn on in philosophical discourse), his work and ideas remain a strong influence in the Muslim Global South revival discourse (Hillier and Koshul, 2015; Koshul, 2015).

From Iqbal (1934), I take the idea of *Khudi*. *Khud* is the Persian word for self. *Khudi*, then, literally translates to selfhood. Iqbal does not mean this to be equated with selfishness, but rather with building a strong sense of character that takes strength from a strong understanding of the role and stature of the self, as intended by Allah for humans in Islam. For Iqbal (1934), having *Khudi* requires the elements elaborated in Table 6 (Faizi, 2021; Koshul, 2015).

For Iqbal, with elements (1), (2) and (3) in Table 6, one can build the disposition to overcome oppression and indignity of the mind, body, heart and soul (or, in other words, as I have framed in this article, the *Fitna* of Being, Knowledge and Power).

When Freire (2017) coined the term critical consciousness, he meant the ability to perceive social, political and economic oppression, and to take action against the oppressive elements in society. Within my theoretical framework, the ability to perceive that Freire refers to in a secular sense would be Iqbal's Khudi, as applied to the context of the problematic beliefs 1 and 2 listed above in the context of monocultural modern science. The ability to take action then means to take action against the *Fitna* of Being, Knowledge and Power within one's own personal capacity. Iqbal's (1934) Khudi and Freire's (2017) critical consciousness in the context of science education becomes ISCC. This is encapsulated in Figure 2, and it will be elaborated on below.

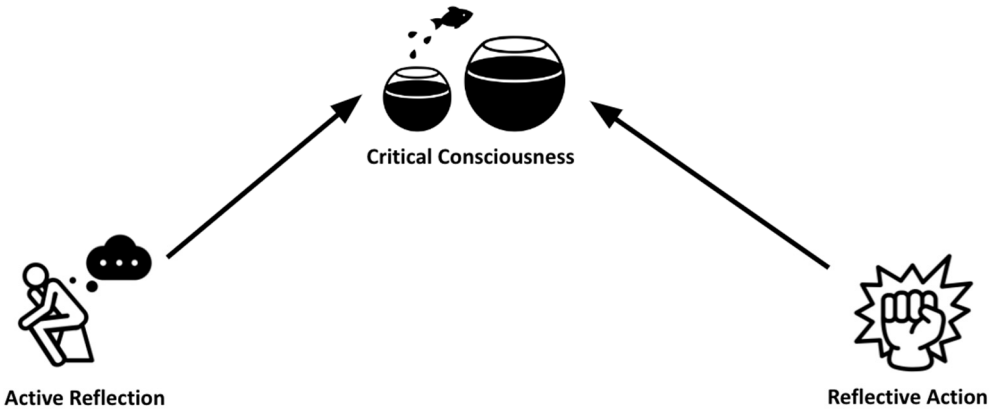
An ISCC-embedded education would aim to inculcate the vision and capacity in the next generation to build back better the Islamic science tradition for the contemporary landscape. A critically conscious

student would be at once aware of the oppressive ideas that one encounters from the *Fitna* of Knowledge and Being in their education and society, and able to envision counters to that *fitna* through the lens of an Islamic framework.

Table 6. Elements of *Khudi*

No.	Element	Sub-elements
1	To know oneself	a. As being a creation of Allah b. As having moral intuition and intellect c. As being a vicegerent of Allah on Earth
2	To know the reality of the universe	a. To believe in the Unseen (such as angels, jinns, other worlds) b. To know that the natural world is not only to be understood in terms of quantities and positivist discourse, but that the natural world also has beauty, purpose and significance, which Allah wants Muslims to discover through scientific inquiry
3	To know Allah	a. His nature as He explains in the Quran b. To see His Signs everywhere in the world

Figure 2. Islamic Scientific Critical Consciousness



The *Fitna* of Being and Knowledge can be countered by decolonising narratives about the historical and contemporary role of Muslims in the intellectual enterprise of science. This also entails re-engagement with Islamic knowledge sources, such as the Quran and Sunnah. However, in contrast to much of the polarising and excluding puritanical discourse of the twentieth century, the *Fitna* of Being and Knowledge require building a sense of collective global Muslim *ummah* (community), with respect for diversity of opinions of those from different sects. This is radical in the sense that most Muslims in schools globally do not study the pluralism in Islamic thought; instead, they are usually directly exposed to only core tenets of the faith, and familiarised with whichever sect of Islam is predominant in their local region or their school's affiliation.

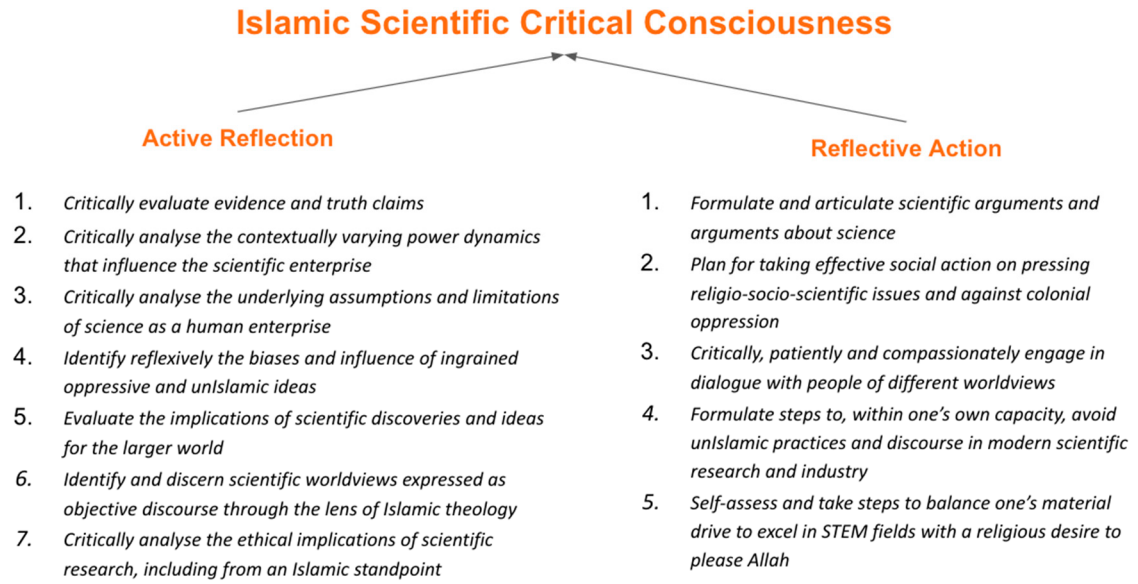
Since reflective action is a key component of ISCC, students must learn how to take both social action and personal action to counter *fitna* in their lives. Through building this kind of ISCC, Muslims would have the vision and skill set to counter the *Fitna* of Power through activism (internally among their own communities, and externally in the larger world).

It is worth asking: what would learning objectives for instilling ISCC look like? Freire (2017) talks about critical consciousness requiring active reflection (to continuously be critically aware of, and be able to identify, hegemonic ideas that are being presented as neutral) and reflective action (to take thoughtful and planned action against hegemony in society within one's own capacity). In other words, to inculcate ISCC is to inculcate:

1. active reflection about how *Fitna* of Knowledge, Being and Power affects one's Khudi
2. reflective action against *Fitna* of Knowledge, Being and Power in order to nurture one's Khudi.

Examples of ISCC learning objectives that would be more tangible, and that would be integrated into the teaching of science subjects (such as in physics, biology and chemistry) as 'cross-cutting themes' are illustrated in Figure 3.

Figure 3. Example learning objectives for Islamic Scientific Critical Consciousness



No list of learning objectives can be exhaustive, and the purpose here is not to attempt to comprehensively outline all the knowledge, skills and dispositions that would be important for inculcating ISCC. These learning objectives are intended as an illustrative example of how ISCC may be integrated into a curriculum. This resonates with education literature that critiques the challenges in attempting to develop a normative list of skills that would entail critical thinking (Hughes, 2014) – as critical thinking by its nature aims to think outside the metaphorical box of normativity, or what is considered common sense. To attempt to comprehensively list such skills would be paradoxically constraining critical thinking to such a box.

In my view, ISCC is something that can be taught, or at the very least learnt. However, this is not an assumption that should just be taken for granted, because the desired learning does not necessarily follow from even the best designed teaching (Biesta, 1998). A single lesson of 60 minutes on racism, for example, would be quite unlikely to change one's internal biases. Indeed, even if one's mindset could be changed, that would still not guarantee a change of dispositions, since these also depend on unconsciously formed habits (Boler and Zembylas, 2002). Similarly, ISCC is not a set of concepts, but a critical mindset accompanied by habits that work to counter hegemonic ideas that feed off the influence of science. For example, Eurocentrism may manifest itself as implicit bias against non-European scientists. Even though one may morally recognise these ideas as oppressive, these tendencies may go unrealised and unchecked in the moment.

So, can the habit of ISCC be inculcated? One does not know what truly transpires in the pedagogical moment between the teacher and the student (Kumashiro, 2000; Sonu, 2016). Nevertheless, one can speak in terms of likelihood. A teacher who sets up a continuous stream of complementary teaching experiences (Boler and Zembylas, 2002) targeted at conditioning the student to engage willingly with

difficult knowledge that is uncertain and discomforting, and that invites re-evaluation of one's outlook (Sonu, 2016), stands a better chance of inculcating ISCC. This theoretical idea relates to the Islamic idea of *fitra*, that is, that all human beings have an innate ability to recognise that there is a Creator and to distinguish between right and wrong (F. Ahmed, 2012). This *fitra* may be dulled through education laden with *Fitna* of Being, Power and Knowledge; however, it may be sharpened through well-designed learning experiences. The agency and intention (*niyat*) of the learner also plays a role. Seeking knowledge mindfully with the intent to please Allah can help increase one's *taqwah* (fear and awareness of Allah) and insight into the workings of *fitna* in human society (Ghazzālī, 1999). However, teaching and learning in an Islamic paradigm is not a deterministic or positivistic process. It is the teacher's responsibility to do their best to facilitate (not force or compel) with wisdom the student towards the path of truth. Only Allah ultimately knows what is in the heart of each believer, and it is He who Wills one to be guided, and through whatever life experiences He Wills.

Reimagining science education with Islamic Scientific Critical Consciousness

What would the ISCC curriculum and teaching look like practically? Below are some general guiding education principles.

Transparency on positionality with critical and Islamic dialogic pedagogy

A recurring recommendation from the literature on science and religion education is that it is better to address controversial topics (Dearden, 2014; Reiss, 2011), such as the creationism versus evolution debate, in a tactful and sensitive manner, rather than to suppress or dismiss such discussion (Reiss, 2011). This is consistent with the Islamic tradition of dialogue (F. Ahmed, 2019). Furthermore, given that ISCC takes the stance that knowledge is not simply neutral and independent of a world view, it is important for teachers to create a culture of being transparent (to the extent that the local cultural context permits) about one's own positionality, the positions on certain topics that are broached in class, and the extent and kinds of knowledge on which those positions are based. This is perhaps a more contentious position to take, given that in science and religious education literature, there is a debate about whether affirmative and procedural neutrality may be the most effective approach (Bridges, 1986; Reiss, 2022), or by design to instead put the spotlight on non-Western narrative, and unpack the context of continued colonial suppression of the Indigenous ecology of knowledges (Gandolfi, 2021; Santos, 2007). ISCC takes the latter stance.

Affirmative neutrality approaches, in my view, do not do a sufficient job (local cultural context allowing) of recognising that even if a teacher claims to be neutral, their body language, choice of evidence and readings presented for discussion and the moderation of discussion are some ways in which power dynamics can still be perpetuated (Applebaum, 2009). This is why it is better to be upfront about one's own views (where this is safe to do) (Applebaum, 2009; Boler and Zembylas, 2002; Picower, 2011), and, at the same time, to be transparent to the commitment to challenge dominant power narratives. In a Muslim-majority context, this may be enabling opinions that are critical of mainstream Islamic views to be voiced, and in a secular context, this may be vice versa (Gandolfi, 2021; Lodge, 2021). This is consistent with the Islamic dialogic approach of *halaqah*, in which students are free to challenge teachers on their positions no holds barred on any topic (F. Ahmed, 2019; Ahmed and Lawson, 2016).

The ISCC framework therefore views with cautious scepticism the discourse (Smith, 1994; Williams, 2015) in science and religious education literature around aiming for provisional acceptance from students to work within current scientific paradigms/models for the purposes of participating in mainstream scientific discourse, rather than challenging their religious metaphysical beliefs (Williams, 2015). From a decolonial perspective, this discourse is problematic, as it implicitly centres students complying and fitting in with the monoculture in order to enhance their social mobility (Carter, 2015) in a system that sustains suppression of non-Western knowledge systems. Epistemic justice (Santos, 2007) necessitates bringing in the social, cultural and historical context of the scientific theories being presented (Gandolfi, 2021), especially for such controversial issues. Indeed, central to this should in fact be acknowledging that within the classroom itself there are power dynamics that privilege what knowledge needs to be accepted and what gets categorised as belief.

Of course, to choose to have open dialogue in which the teacher is themself opening up to critique can be discomforting (Boler and Zembylas, 2002). Part of this discomfort may very well be felt from backlash received in the form of some students not engaging or complaining about the teacher as being biased (Applebaum, 2009). Nevertheless, it is important to bring Indigenous world views to the forefront, even if this involves deliberately allowing certain narratives/knowledge more limelight than those of students who are speaking dominant narratives from a position of privilege (Applebaum, 2009; Gandolfi, 2021). Facing backlash is part of the risk that is associated with taking the bull by the horns (that is, questioning the colonial dominant monocultural world view of science) (Biesta, 2015). It is worth emphasising here that in contexts in which open discussion is not possible, other modes of dialogue can be deployed under the radar to critically unpack the dominant discourses (Picower, 2011), and to release the imagination outside the monoculture, for example, through artistic expression such as role-play activities and discussing fiction (Greene, 2011).

The above approach is compatible with Islamic values, as a Muslim is not supposed to compel another to follow Islam (Ahmed and Lawson, 2016), but rather to invite them through setting a good personal example and providing *da'wah* (to preach and advocate with wisdom and effective reasoning, in light of the Quran and Sunnah, in a way that is appropriate to the target audience and local context) (Ahsan, 2002). This does not mean, in my view, that in a multifaith classroom context in the West a Muslim teacher should start preaching to the class. To do so would run counter to the trust (or social contract) placed in the role of the teacher by the school community. In such a school context, the Muslim educator can find common cause with broader multicultural social justice movements to struggle against dehumanising narratives, and to empower those of all faiths to be able to live free of epistemic and physical oppression. Such effort could entail countering in class those aspects of *Fitna* of Power and Knowledge (see Figure 1) that may stem from coloniality, for example, problematising the idea that religion and science necessarily conflict with each other, or that Europeans are superior to other people. Broader *da'wah* activities could occur in other appropriate forums, such as in mosques and through religious informational public events.

In the confessional Muslim faith-based classroom setting as well, there should equally also not be forceful imposition of the teacher's views. As elaborated earlier, reaching truth requires approaching a matter with the correct *niyah* (intention), and engaging in dialogue that is respectful, open and tactful. From an Islamic standpoint, it is not the one who gives *da'wah* who changes the beliefs of the one receiving *da'wah*, but rather it is by the Will of Allah (F. Ahmed, 2019; Ahsan, 2002). The teacher should therefore encourage critical thinking, respect differing points of view and endeavour to give the platform to those voices that may be suppressed (these may be those of non-Muslims, or of those from Muslim minority sects, for example) due to sociocultural power dynamics.

Present science and religion as pluralistic world views

As this article has argued, both science and religion are spectrums of world views. Some scientists may consider it scientific to believe that the universe came into being by random chance, whereas others may think that this falls into the domain of philosophy or religion. Similarly, Muslims (even from the same denomination, such as Sunnis) may have different theological stances (creed or *aqidah*) regarding how Allah acts in the world (such as being of the Ash'ari, Maturidi or Athari schools of thought). Hence, it is important that in conversations neither 'science' nor 'Islam' should be presented as monoliths.

Interdisciplinary connections and Islamic knowledge framework

Although there is a rich debate about knowledge taxonomies in Islamic philosophy, generally within an Islamic framework science in the modern sense is not compartmentalised as being separated from philosophy (M. Iqbal, 2002). In the science and religious education literature, Billingsley et al. (2019) and Erduran et al. (2019) emphasise the importance of helping students critically appreciate how people of different faiths structure arguments on the basis of different kinds of epistemic authority, and of promoting skills for dialogue on sensitive topics. Importantly, the recent work of thinkers such as Boisselle (2016) and Lodge (2017) in the Caribbean, and Gandolfi (2021) in the UK, has emphasised the importance of reflecting on the nature of science by shifting the centre of gravity from Western historical and philosophical discourses to meaningfully engage with the perspectives of the Global South, and of other marginalised communities. In all this scholarship, there is synergy with the ethos of traditional

Islamic education, in which critical thinking about the classification of knowledge and the epistemic nature of each discipline of inquiry is important and in dialogue with multicultural perspectives (Ahmed and Lawson, 2016; Bakar, 1998; M. Iqbal, 2002).

Social action and personal action projects on socio-religio-scientific issues

As ISCC involves reflective action, it is important that students be provided with the opportunity to carry out (safe and contextually feasible) classroom projects that help them learn how to counter the *Fitna* of Knowledge, Power and Being in their own capacity. Some examples of social action projects are illustrated in Table 7.

Table 7. Example social action projects for ISCC

Topic	Detail	Rationale
Awareness project on mental health	Destigmatising discussions about, and experiences of, mental health conditions by running campaigns in collaboration with mental health experts and religious scholars.	This counters the *Fitna* of Knowledge and Being by helping communities appreciate that seeking support for mental well-being is Islamic, and creating awareness about the work of contemporary Islamic scholars in the field of psychology, so as to encourage trust that counselling services can be coherent with one's own religious beliefs, rather than necessitating a secular world view.
Decolonising the history of science	Countering colonial narratives that diminish the contributions of Muslims and Global South thinkers to science, including those of women, by creating podcasts around these themes.	This counters the *Fitna* of Knowledge and Being by stimulating conversations among youth about how thinkers who have not received the spotlight can become figures of inspiration for others to excel in science.

Holistic assessment

Learning is a nebulous, multidimensional phenomenon, and ISCC is a combination of mindset and habits. From an Islamic perspective, only Allah knows what is in the hearts of humans, and their actual strength of faith. The aims of assessment for teachers therefore become centred on using formative and summative techniques (these will depend on the schooling context, but they should ideally involve conducting authentic performance tasks) to check understanding regarding some of the knowledge (such as concepts regarding types of common argumentative fallacies) and skills (such as being able to identify secular world-view ideas being expressed as common sense inside scientific textbooks) that are taught in order to sow the seeds of inculcating ISCC.

To conclude this section, Table 8 illustrates how the aforementioned pedagogical principles could be applied in a practical lesson plan.

Conclusion

In this article, I presented a decolonial science education theory of aims within an Islamic paradigm by proposing the idea of inculcating ISCC. This was followed by a discussion of practical examples of how it could be implemented in a variety of contexts. Nevertheless, a key challenge remains that there is a paucity of curriculum materials to help realise this in practice for educators. Developing these materials after piloting them through action research in diverse schooling contexts would be an important next step. Moving beyond the level of individual schools, it would be helpful to do further academic work on the kind of educational policy initiatives that would need to be taken to enable inculcation of ISCC in Muslim country contexts, and faith-independent general scientific critical consciousness in secular

contexts. There are also other aims of science education from an Islamic motivation that are in need of further exploration – especially at the secondary school level, such as instilling awe in students about the wonders of Allah's creations in nature, and other more worldly matters, such as how to maximise social mobility for students through globally competitive science education.

Table 8. Reimagining speaking about the history of Muslim science in a Muslim faith-based classroom

Lesson(s) outline	Questions to promote ISCC (these can be private self-reflection or in group discussion)
Ask students to flip through their science textbooks and table the gender, religion and race of the famous scientists mentioned.	a. Why are some groups (women, non-White ethnicities and so on) under-represented? b. What do the Quran, Sunnah and Muslim scholarship say about the *fitna* of success and challenges of life in this world for individuals, and for communities as a whole? How can that relate to the erasure and emphasis of certain historical narratives being conveyed in these science textbooks?
Ask students to research and present on the historical scientific accomplishments of the Muslim world from different time periods and geographical regions.	a. How did the accomplishments connect/collaborate/build on the work of other communities and vice versa? To what extent, and based on what evidence, do you think following Islamic values and motives contributed to the accomplishments? b. What sources did you rely on, and how did you judge their reliability? Did you find any gaps in the history during any time period and across different regions and for different subaltern (including women and non-Muslims) groups? If so, why do you think these are there? c. Did you find any interesting contemporary scholars who are working to fill in the gaps or revise the history? What are their motivations? d. Was there a rise and a decline in science in the Muslim world? On what sources of knowledge do you base your views? e. What do the Quran, Sunnah and Muslim scholarship say about the reasons for the rise and fall of societies, and how to critically infer moral lessons from history?
Invite students to collectively reflect on how their Khudi is affected by the historical narratives to which they are exposed.	How is your Khudi affected by the historical impressions from: a. Your school textbooks, such as your history, religious studies and science books b. Stories about the past that we learn from living in our society (such as through family, public intellectuals, religious leaders and local media) c. The influence of globalisation/Westernisation from international media.
Work with the students to design social action projects (for example, see Table 7).	a. Is your plan of action logistically feasible and safe? Are you following an ethical approach? How will you balance your responsibilities to the community with those to yourself and your family? b. How does your action plan counter the *Fitna* of Power, Knowledge and Being? c. What is your *niyat* (motivations) for doing this work, and how will you keep it pure? How will carrying out this plan strengthen your own *Khudi*, and that of your community?

https://doi.org/10.14324/LRE.22.1.09

In conclusion, it is worth re-emphasising that for Muslims, as well as for other groups that have experienced colonisation, it is important to unravel the colonial matrix of power that thrives on the ethos of divide and conquer. This can only happen when compassionate unity is sought as an aim in order to foster healing across polarised groups, and when the motive is not to fight the metaphorical fire of oppression with further fire. Hence, this article has argued for a critical consciousness that celebrates plurality, looks critically at the past and present, and aims to build an Islamic science tradition back better. As the Quran says, 'Surely, Allah does not change the condition of a people unless they change themselves' (*Surah Ar-Ra'd – 11*, n.d.).

Acknowledgements

An earlier version of this article was presented at the Islam, Science and Education Conference, at the Faculty of Education, University of Cambridge, 1–2 July 2023, (https://www.educ.cam.ac.uk/events/conferences/islam-science-and-education/), and at the European Science Education Research Association (ESERA) Conference, Cappadocia, 28 August–1 September, 2023 (https://virtual.oxfordabstracts.com/#/event/3790/submission/1029).

Funding

This work was supported, in whole or in part, by the Bill & Melinda Gates Foundation [OPP1144]. Under the grant conditions of the Foundation, a Creative Commons Attribution 4.0 Generic License has already been assigned to the Author Accepted Manuscript version that might arise from this submission.

Declarations and conflicts of interest

Research ethics statement

Not applicable to this article.

Consent for publication statement

Not applicable to this article.

Conflicts of interest statement

The author declares no conflicts of interest with this work. All efforts to sufficiently anonymise the author during peer review of this article have been made. The author declares no further conflicts with this article.

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