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Unearthing the coloniality of neoliberalised curricular discourses to promote a public orientation towards secondary science education

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ABSTRACT

Considering the challenges facing curricula in science education forces a reckoning with neoliberalism and its transmogrification of education, generally. Science, which has contributed significantly to humanity, is exalted in neoliberal secular discourse and forms a key pillar of social policy governance. However, the progress and innovation attributed to scientific education, within the broader STEM agenda, must be read against the rise in societal inequalities wrought by far-right hostilities and the general erosion of democratic principles in the milieu of neoliberal policy making. This is especially prescient for science curricula given the widespread crystallisation of scientism in society and its role in framing anti-equality arguments. This must also be situated against the broad resistance movements that have arisen, demonstrating the resilience and promise from alternative perspectives such as decoloniality. While decolonial theory reckons with the epistemological violence of science, these perspectives remain underdiscussed in STEM fields. This is necessary for contemporary science curricula given the broader neoliberal erosions of public education that champion instrumentalism and mass measurement in the name of capitalism. This forms the impetus for this conceptual article which presents a decolonial consideration of recent curricular discourses in science.

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Introduction

Considering the contemporary challenges for science curricula requires reckoning with the broad forces of neoliberalism and their imposition on the field of education. Impelling the global transmogrification of curricula and the perpetuation of widescale inequalities, these forces have particular relevance for the field of science education given its central status within the Science, Technology, Engineering and Mathematics (STEM) agenda, imbued with the logics of neoliberalism from its genesis (Delahunty, 2023). These issues remain largely uninterrogated across mainstream accounts of curricular positionings. With science (the study of the natural and physical world) naturalised

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into the genealogies of western nations as a key driver of economic growth, the logics and epistemologies of the field have been appropriated into sociocultural realities and readily adopted within the rules of contemporary state governance (Ezrahi, 2012). These forces have crystallised the position of science within the modern society, with inherent ties to the neoliberal capitalist project. The totalising forces of neoliberalism (Ball, 2016) centres the necessity to deliberate the public role of science education.

It is unquestionable that science has contributed positively to our world. However, these positive contributions of science, particularly when considering the challenges faced within curricular imaginings, need to be situated in light of the counter valences of barriers to true social justice and equality. For instance, it is true that science has led to much of the enhancements in living that many of us benefit from (e.g. medical advancements). However, it is also true that neoconservative forces (e.g. far and alt-right movements) present significant barriers to social justice across the globe. For example, at the time of writing, various incidents in Ireland targeting the hosting of public readings to children, from the LGBTQ + community, where groups of heteroactivists¹ (Nash & Browne, 2020) have physically interrupted and verbally abused staff and volunteers in community libraries (O' Byrne, 2023). While these neoconservative movements often mobilise narratives situated in ethnoreligious defences, many of these groups also draw heavily on scientific grounds² 'based on supposedly self-evident rules of biological essentialism' (Nash & Browne, 2020, p. 119). These heteroactivist positions are an example of the penetration of scientism (ideology premised on an excessive deference to the explanatory power of science) within the public psyche and the contested sites of childhood and adolescence subjectivities (Delahunty, 2024), where many of these vulgar forces target. This signals the critical role and place of curricula in science within the contemporary landscape.

In this article, I argue for the centrality of science education in mobilising resistance to the ideological appropriations of scientific knowledge (scientism) permeating contemporary societies. As neoliberal forces continue to shape educational policy and curricula across the globe, the rise of globalisation has concomitantly resulted in the increased diversification of school populations. In the case of Ireland, where immigration rates are at record high levels, 13% of the population are recorded as non-nationals³ reflecting an increasingly diverse body politic. The case of Ireland is mirrored across many international contexts and the implications for contemporary STEM education are notable. While much of the discourse in STEM centres around the issues of female representation, comparatively less attention is paid to the underrepresentation of other minorities; sexual and ethnic (Kang et al., 2019; Sansone & Carpenter, 2020). Whereas neoliberal capitalism, as well as the rise of far-right ideologies, has perpetuated widescale inequalities and injustices, it has also fomented movements of resistance, such as from the perspective of decoloniality.

The necessity to embrace these critical perspectives – a task which this paper adopts – is perhaps most apparent across sites of education, which historically have been constituted, and at times deliberately weaponised, for the purposes of colonisation (Freire, 1996). Moreover, the increasing neoliberalisation of educational policy and curricula globally has leant itself to the widescale masking of coloniality which resides within and bolster capitalist agendas (Shahjahan, 2011). Moreover, in line with the secularisation of modern societies, science as a domain of study has been elevated in curricular discourses, particularly those centring the necessity of an advanced STEM education

provision to satisfy economic interests. This has resulted in the predominance of curricular discourses in science education focused on ‘raising standards’ and teacher accountabilities (Sharma, 2017), averting considerations from the material (e.g. political-economic, ontological) and symbolic (e.g. epistemic, sociocultural) aspects of science, and their sociohistorical developments, with connections to social understandings. Despite the positive contributions of science globally, decolonial perspectives have cohesively demonstrated the ‘darker side of modernity’ (Mignolo, 2023), where accounts of the role of science in supporting and concomitantly benefiting from colonial oppression and violence are less discussed. When reading these histories in light of the increasing neoliberalisation of social life, bolstered by the ascent of ‘performative scientism’ as a common sense and governing rationality (Delahunty, 2024; Muller, 2021) the potential for the reproduction of coloniality in contemporary science curricula is significant. To be clear, I am not arguing against the contributions that the rigorous scientific study of areas, such as medicine and climate science, have made to our world, but am advocating for the necessity for a more complex reflection on the framing of science curricula in public education.

This paper takes up the task of advocating for ‘politicalness’ of curriculum in science education, which I argue as a key site in which a critical awareness and orientation towards science must be formed in order to both challenge these scientific mutations in our broader society and forward a democratic imagining of science education. With this contribution I aim to join other scholars in STEM education who have begun to discuss the necessity to decolonise this space (e.g. Cassiani, 2021; Kato et al., 2023; Rosa & Mensah, 2021; Rüschenpöhler, 2023) in order to build towards new curricular imaginaries. This article is principally concerned with critiquing and unsettling, to borrow from Tuck and Yang’s (2012) inducement that decoloniality should be unsettling for all, the general neoliberal discourse surrounding curriculum in secondary level science. Situating science as coproductive in the imagining of modern social democracies (Ezrahi, 2012; Jasanoff, 2004, 2015), with separation of values from facts (Haraway, 1988), and hence political rationalities (Muller, 2021), presents a notable concern for science curricula broadly, and in Ireland particularly, which is in an era of widescale educational reforms. I will argue that there is an urgent need to excavate the colonial logics of neoliberalism from science curricula, and STEM education more broadly in order to challenge and re-envision curricular approaches for equity and justice.

The major part of the article offers the chance to consider the sociocultural position of science curricula, within the ongoing neoliberalisation of education. This recognises the place of the science curriculum as more than an instrument for cultivating scientific literacy and challenges the science education community to begin to reformulate what a public⁴ (cf. Clarke et al., 2022) vision of science may look like. To undertake this task, this article draws on decolonial theory, which necessarily involves the animation of ‘coloniality of curriculum’ (Fúnez-Flores, 2023; Leonardo, 2018). This is undertaken in the next section followed by a deconstruction of the ‘veil of neutrality’, that surrounds common sense misappropriations of science, and accounts of scientific knowledge, which bolster the ideology of scientism (Gasparatou, 2017). This is critical to unsettling any mistaken notion of science as an objective body of knowledge which is immune to a politics of neoliberalisation or indeed, an area responsible for public visions of education. This I achieve through a positioning of science within the colonial matrix of power

(CMP) before considering how its ostensible neutrality naturalises political passivity within the milieu of neoliberal capitalism, colonising possible educational subjectivities. In the last sections of the paper, I explore recent discourses regarding science curricular reform in secondary education in Ireland as an example in order to demonstrate a ‘local’ logics of global neoliberal coloniality that enunciate a landscape of hegemonic potentialities, where science curricula reform remains amputated from its democratic and political responsibilities.

Decolonial positionality

Decolonial theory draws primarily from Latin American contexts and is typically linked to the work of Anibal Quijano, who differentiates it from colonialism through the preservation of the logics of colonial domination which is argued as ‘the most general form of domination in the world today, once colonialism as an explicit political order was destroyed’ (Quijano, 2007, p. 170). This position therefore rejects any potential historical relegation, centring the contemporary relevance of coloniality to social policy. This is reflected in the centrality of racisms and the ‘progressive developmental rhetoric’ that characterises political discourses of ‘modernity’ (Harding, 2016; Mignolo, 2010; Mignolo & Walsh, 2018; Quijano, 2007). According to Walter Mignolo, decoloniality signals the role of knowledge as interwoven within praxical spheres of ‘history, politics, economics, race, gender, [and] sexuality ... that entangles us to the point of making us believe that it is not knowledge that matters but really history, economy, politics, etc. (Mignolo & Walsh, 2018, p. 135). Anibal Quijano’s articulation of coloniality – or more completely, *coloniality of power* – stresses the centrality that the coloniality of knowledge holds in exercising power within the conceptual frame of modernity/rationality extending to present-day capitalism (Bhambra, 2014). The inequality of knowledge at the heart of coloniality, for Mignolo (2023, p. 42), ‘is a component of racial inequalities: non-white “races” and non-Christian religions were destitute, first, by the growing hegemony of Christian theological knowledge and, later, by secular sciences ...’. Decoloniality forces the realisation that the capitalist world is built and solidified on racism in ways that privilege white Eurocentric cosmologies as the universal normative for all of humanity (Bhambra, 2014; De Lissovoy, 2019; Wright, 2022; Mignolo & Walsh, 2018). These logics subsequently extend to neoliberalism (De Lissovoy, 2015) through its inflections of coloniality of knowledge, tied to the rational self-serving individual, to be ‘considered then in the same way as property – as a relation between one individual and something else’ (Quijano, 2007, p. 173). This particular logic stands in opposition to any conceptualisation of subjectivities founded on interdependence and relationality among communities, and is the basis of humanistic epistemologies since the Enlightenment (Braidotti, 2013).

As epistemology and knowledge are core foci for decolonial approaches, it is constructive for a broad analysis, such as in this paper, to stress the geopolitics of knowledge which affirms the politicalness and situatedness of all knowledges (Shahjahan et al., 2022). Mignolo (2002) draws out the essence of geopolitics of knowledge central to the functioning of the CMP; the phenomenon that certain ‘local’ knowledges have been elevated in the imagining, and implementing, of global sociopolitical realities. This calls attention to the multifarious dominance of Western epistemology in universalising a

specific vision of the world, synchronously excluding any others. These geopolitics of knowledge lead to Mignolo's concept of *enunciation*, which excavates the symbolic structures external to domains (e.g. political, sexual, epistemic) of the CMP, 'where the domains are defined and interrelated' and where 'patriarchy is located' (Mignolo & Walsh, 2018, p. 143). The enunciation is the location of knowledge and 'composes of actors, languages, and institutions' (Mignolo & Walsh, 2018, p. 143). From a historical perspective, these knowledges remain resistant to the ambivalences (Bhabha, 1994) encompassed within the transitioning from religious to secular temporalities characteristic of modernity. Put more plainly, these knowledges are dynamic and adaptive to the evolutionary potential of the enunciation aligned to specific sociohistorical contexts and events. Science, therefore, is deeply implicated in the CMP (Mignolo, 2023; Mignolo & Walsh, 2018; Seth, 2009).

Coloniality/decoloniality facilitates a critical examination of the ways discourses, theoretical perspectives, and knowledges produce/reproduce domination (Fúnez-Flores, 2023). Applying this perspective to curriculum underlines its political implications, particularly the operationalising of curricula as technologies of control and social reproduction (Fúnez-Flores, 2023; Kelly, 2009). This signals the complex manners in which dominant curricula propagate and define subjectivity or frames of being, actualising imperial colonial logics, notably in the foreclosing of possibilities (Fúnez-Flores, 2021, 2023). This position allows us to move beyond the content of discourse produced in official educational policies and curricular documents, to consider the frame under which these knowledges are delineated and subsequently define material and symbolic relations. This facilitates the explication of coloniality elided within neoliberalised and ostensibly neutral policy. This adds a novel depth of critique to the literature examining neoliberalism in contemporary science curricula, and notably signals the simultaneous politicalness of curriculum and science to reflect upon the responsibilities/purposes of present-day science education. It is incumbent to firstly consider the position of science itself within the CMP.

Unsettling the 'veil of neutrality': science in the Colonial Matrix of Power

Within this section, I present a decolonial positioning of science to challenge any notion of apoliticalness of scientific knowledge. I approach this from a coloniality of power stance so will not have space to delineate a thorough epistemological interrogation of common claims to 'objectivity'; for this Harding (2017) is informative.

Decolonial theory stresses a 'de-linking' from the epistemic foundations of western thinking to illuminate the darker side of the 'rhetoric of modernity' (Mignolo & Walsh, 2018, p. 3). The dehumanisation of indigenous communities, facilitated by the co-constitution of science and colonialism (Harding, 2019) was essential to the growth of capitalism, and extends today to its neoliberal formations (Lipman, 2011; Wright, 2022). Decoloniality directly interrogates the epistemic properties of the modern ontological condition where 'ontologies are cosmologic/epistemic creations (storytelling about the creation of the world (cosmologies)) and principles of knowing within a given cosmology (epistemology): it is through knowledge that entities and relations are conceived, perceived, sensed, and described (Mignolo & Walsh, 2018, p. 135). Crucially, it is the knowledge generated by Western science that has

facilitated this grand political narrative and a democratic science curriculum needs to confront this.

The centrality of science and technology in facilitating colonial expansion is well documented, despite the lack of attention it receives in popular curricular discourse. As Seth (2009, p. 373) explains these two areas were considered ‘gifts that Western imperial powers brought to their colonies [as] part of the discourse of the ‘civilizing mission’. Within these colonial logics, science was used to legitimise racism, elevating white Europeans to the apex of a human hierarchy, with other indigenes relegated to the status of primitive beings and in need of civilising, thus justifying imperialism (Harding, 2019; Seth, 2022). Moreover, science itself was a direct beneficiary of settler colonialism through an accumulation of indigenous knowledges and technologies, not to mention the notorious violence committed against indigenous populations through scientific experimentation (Dodson, 2005; Harris & Ernst, 1999; Seth, 2022). With time more sophisticated justifications for domination were required. Zuberi (2001) asserts that this was facilitated by Social Darwinism (the application of Darwinian evolutionary theory to describing/predicting sociocultural phenomena) and eventually eugenics. Darwinian theory thusly provided justificatory power in creating a racial hierarchy that was core to the colonial-capitalist project (Smith, 2012), which is maintained within the logics of racial colonial-capital accumulation in neoliberalist societies (Issar, 2021; Wright & Kim, 2023) and through the coloniality of subjectivities (Maldonado-Torres, 2007). Smith (2012) positions the activity of defining the ‘human’ as a mechanism for hiding the implicit rules that structured society, masked in altruistic claims which all the while took Eurocentric modern man as the developmental goal for a civilising agenda. Eurocentric scientific rationality was ‘imposed [with] its paradigmatic image and its principal cognitive elements as the norm of orientation on all cultural development, particularly the intellectual’ (Quijano, 2007, p. 170). This highlights the domination which the scientific form of knowledge achieved historically and maintains today in the CMP (Mignolo & Walsh, 2018) within the broader ‘scientization’ of social life (Habermas, 1971), including contemporary educational policy discourses (Delahunty, 2024). This domination simultaneously achieves an ostensible universalism for Eurocentric knowledge and an overt epistemic violence in an erasure of indigenous sciences, espoused in the common sense ‘objectivity’ and monism of contemporary scientific (and scientific) discourses (Kato et al., 2023).

The value-neutrality assumed within scientific narratives, and a characteristic factor of the positivist and neopositivist forms that dominate public policy, serves to position a dualism between science and culture/nature (Robles-Piñeros et al., 2020). This renders anything not defined as human as controllable, as it is utilised in neoliberal contexts, primarily for capitalist expansion (Kato et al., 2023). According to Lloyd and Wolfe (2016) the coloniality of the present day neoliberal state extends towards the inevitable surplus of ‘its economic regime’ and ‘how to manage ... the threat it poses’ (p.110). This implicates the coloniality of scientism in informing processes of governing bodies in education through, for example, over-psychologised tropes of childhood (Burman, 2012) or the naturalisation of market logics in education facilitated by an ‘obfuscating numericism’ (Moore et al., 2011, p. 509). While this contemporary enunciation facilitates a present-day colonial domination through education, it also presents spaces for resistance and, unfortunately, also for further societal hostilities. In the introduction I referenced the

reorientation of heteroactivists embracing ostensibly scientific bases. While these narratives could be dismissed as some form of ‘post-truth’ politics, and are certainly vulgar, Kwok et al. (2023) argue for a more nuanced consideration revealing a potential societal impatience with scientific bases for government decision making.

This reveals a clear responsibility for the curricular framing of science education, which is the primary route where many children and adolescents first encounter and develop an understanding of science and scientific knowledge. The question therefore focuses on how the coloniality imbued within the neoliberalisation of STEM contributes to a passive scientism among students and other stakeholders. In further positioning the need to embrace the political elements of a science curriculum, the next section excavates the pattern of coloniality within educational politics tied to neoliberalism.

The coloniality of neoliberalism: science for political passivity?

While scholars such as Apple (2011) and Ball (2016) have delineated the societal changes since the 1970s engendering the advance of neoliberalism, its present incarnation in its ‘late’ form is salient since the financial crash of 2008. As demonstrated by McGimpsey (2017), Bradbury et al. (2013), De St Croix et al. (2020) and Kiely and Meade (2018), across U.K. and Irish educational and youth policy contexts, there has been an intensification of the marketized principles of neoliberalism elevating the image of the rational individual as the subject of social policy, and imbuing the technologies and logics of behavioural economics into general praxis. For education this has inculcated a general culture of instrumentalism (Ball, 2015; Todd, 2022).

Biesta (2007, 2009) argues that the modern policy landscape in education is dominated by political imperatives to improve learning, often conflated to mean education. This ‘learnification’ agenda ties education to servitude of national economic interests. This serves to centre the teacher as a causal force in student achievement, which is typically associated with performance on standardised summative assessments at national and international levels (Ball, 2000; Biesta, 2009). For science education, this in part has led to the overrepresentation of research on teaching and learning methods in the field as opposed to issues of democracy and subjectivities (Cassiani, 2021). This culture engenders a technicist reduction of the professional democratic practices of teaching and elides a broader set of purposes for education, including *subjectification* and *socialisation* (Biesta, 2009, 2017). The narrowing of education’s purpose is derivative of a broader societal mutation structured around the visage of the ‘free market’ as a model for social life under neoliberal capitalism. As thoroughly expounded by Lynch (2022), neoliberalism operating through its ‘atomistic market relationships, aligned with and valorized within capitalism ... cultivate social relations built on risk/reward calculations ... encourage individuals to be highly competitive ... in relation to job security, material wealth, social status or moral worth’ (pp. 26–27). She argues that this ‘feeds disinterestedness and detachment from unaligned and unusable others’ and, coalescing with rising inequalities and social tensions, contributes to ‘political detachment and [undermining] the trust that underpins social solidarity and care ...’ (p. 27). This social apathy, influenced by late neoliberalisation, has bolstered a new hegemonic common-sense (Torres, 2013) within curricular discourse in STEM education, facilitated by the primacy of instrumental reason tied to the prototype of the rational individual (Vilanova

& Martins, 2017). The coloniality evident within these ideological influences are deceptively hidden within what appears as natural structures of reality pitting anyone outside of this ideological frame (those who do not make self-interested rational decisions) as irrational and in need of intervention (Bradbury et al., 2013; Lynch, 2022). These logics hide the inherent ‘civilising’ logics of coloniality within the constructions of neoliberal subjectivities, flowing to govern students (viewed as future workforce talent) through the promotion of ‘monoculture[s] of mind’ (Shahjahan, 2011, p. 191). This overview of the coloniality revealed in the neoliberalisation of educational subjectivities (of all stakeholders; students, teachers, policy makers) sketches the form of enunciation currently framing the rhetoric of modern educational curricula. Science and STEM curricula, in particular, encompass a sensitivity given the cultural/economic capital they claim in our modern societies.

From a curriculum-making perspective the focus on science education manifests in the discourses surrounding educational rankings in international assessments, normally PISA. In the Irish context, sensationalist headlines such as ‘Students’ ignorance of basic maths is sum of all our fears’,⁵ which actively castigate the education system for poorer than expected performances in PISA are a regular cultural feature of the neoliberalist milieu. These of course can also be extended to reading and science domains given their regular appearance in different iterations of PISA since 2000. While on the surface, this is a sociocultural manifestation of the globalised phenomenon of inter-governmental organisations’ influence in educational policy discourse (Sellar & Lingard, 2014), this reading elides the larger more complex assemblage of colonial apparatuses at work to construct a massified form of homogenised educational-economic governance, expressly through the coloniality of curriculum reforms. The civilising agenda within PISA is replete in the OECD’s regular declarations of its purpose beyond an assessment tool. For example, d’Agnese (2015) analyses the coloniality organic to PISA’s espoused instrumentality, demonstrated in claims to determine how well students are prepared for life and argues that as a result it ‘seems to be more of a life brand than an assessment tool’ (p. 58). Not only does this embody the OECD’s primarily neoliberal concerns for education and student subjectivities, but it also highlights its role as an implicit curricular enunciation (Takayama, 2018). Further, as explicated by Hughson (2024) this can be considered as but one colonial instrument of the OECDs larger neoliberalised ‘modernising mission to build “predictable” (and therefore increasingly homogenous) national curricula’ (p. 2). This forms part of the larger colonising project of neoliberal capitalism ‘which promotes certain modes of understanding anchored in the Global North at the expense of others in the Global South’ (Hughson, 2024, p. 2). In situating this analysis within a decolonial frame, it is therefore constructive to highlight the parallels between the logics of educational developmentalism, promoted by the OECD, and the relationship to ‘modernising’ politics within the larger scope of coloniality (Klein, 2017; Mignolo & Bussmann, 2023; Quijano, 2007). There exists a particular colonial association between developmentalism and the notion of modernisation, which are almost entirely framed as if they are inherently benevolent processes and used as justifications for framing indigenous or minority populations as uncivilised or deficient.

The civic passivity, which this paper argues may be implicitly bred within STEM by increasing neoliberalisation, is underscored by research indicating that STEM professionals demonstrate some of the lowest civic engagement values (Garibay, 2015).

The apathetic social positions engendered by the expanding neoliberalisation of society is consensual to the intensification of scientism (Delahunty, 2024) and imbricated within the general modelling of science curricula, which is typically modelled on the presumed nature of professional/industrial science. Kato et al. (2023) argue that the actual framing of science curricula broadly corresponds to a dated nineteenth-century image of the solitary disinterested scientific figure, echoing the apolitical conceptualisation of knowledge. Of course, even this framing alone is a distortion or illusion, given the politically motivated colonial utilisation of science highlighted earlier. Framing the content of science curricula in the image of an objective, disinterested field constructs science under the coloniality of capitalist logic and its associated scientific-technological power eschewing the universality of the West (Kato et al., 2023), further relegating the potential for socio-political positionalities (Galamba & Matthews, 2021). Furthermore, while there is a naïve temptation to maintain that science should not be political there is research that demonstrates current colonial logics being replicated in the standard Western treatment of science. For example, there is evidence to suggest that biological principles of race and ethnicity differences are still reproduced within biology textbooks used in classrooms globally (Donovan, 2014; Willinsky, 2020) upholding the coloniality of essentialised ‘scientific’ differences. However, these findings have to be understood in the broader dominance of Eurocentric theories, principles and knowledge which characterise the mainstream approach to science education globally (Cassiani, 2021) and are naturalised in the homogenising individualistic rationalities of neoliberalism (Higgins, 2021; Kato et al., 2023).

This section has attempted to excavate the coloniality inherent in the continued neoliberalisation of educational subjectivities through curricular discourses. This has significant implications for the position of science in the secondary school curriculum. The OECD’s larger colonising shadow exerts particular knowledge claims on science education, positioning a technocratic Eurocentric conception of educational provision (Delaune, 2019; d’Agnese, 2015), as well as a definably Eurocentric-western notion of scientific content knowledge (Kato et al., 2023). The next section will move to consider the specific case of curricular discourses surrounding STEM and science in Ireland, given the significant policy and curricular evolutions of the last decade.

‘Flawed templates’: reflections on the current state of science curricula reforms

Having centred the dominance of neoliberal ideologies within contemporary understandings of STEM curricula, in this section I seek to reflect upon recent discourses on science education reform in the Irish context. While my decolonial reading remains focused on the enunciation framing these discourses, I will present examples from official sources such as national policy, reports, and recent governmental debates on STEM education to excavate these logics. My aim is to unsettle and disrupt the neoliberal coloniality elided within the discourses from official stakeholders, which are often unbeknownst to individuals themselves.

The science curricula are a topic of interest at the present time of writing, given that they were introduced within the current Leaving Certificate⁶ programme of study in 1999 and remain unchanged (van Kempen, 2022). While new specifications for senior science

subjects were agreed in 2014, they were not implemented. Subsequently, a new reform initiative begun in 2019 with a view to creating new curricula for biology, chemistry and physics (NCCA, 2019). Due to events, such as the COVID-19 pandemic, these have been delayed. This positioning and reform impetus for science at senior level (ages 15–18) in secondary education in Ireland should be read against the nation's broader incentivisation of STEM education in the last decade.

In 2017 the first national policy on STEM education was published (DES, 2017) which states Ireland's political ambitions to 'become the best education and training service in Europe by 2026' and centring STEM 'at the heart of a technological revolution which is transforming the way we live and the way we work' (DES, 2017, p. 3). While the policy presents a need to reconsider and improve educational provision in STEM across all levels of education, there are notable exemplars of neoliberal coloniality within the official discourse. For example, the alarming inclusion within the introduction of the need for 'a national focus on STEM education in our early years setting and schools' is proclaimed within the same sentence stressing the necessity to ensure 'a highly-skilled workforce [is] in place' (DES, 2017, p. 5). The coloniality imbued within policy that seeks to capitalise on early childhood bodies for the future workforce, which from a decolonial reading that sees coloniality and capitalism as mutually imbricated, is complicit with the logics of racial capital accumulation (Issar, 2021). This lends a sobering interpretation to elements of the foreword of the recently published *STEM Education Implementation Plan to 2026* (DES, 2023) helmed by the Minister for Education. Here, the presentation of natural child curiosity and innovation positions them as 'predisposed to the type of invention and inquiry that are central to the world of STEM ...', coupled with the prioritising of quality education which 'fully nurtures ... children and young people in participating fully in these spheres ...' (DES, 2023, p. 2). The romantic presentation of child innocence and curiosity is essentialised within developmentally normalised childhoods within the neoliberal phenomenon of psychologised subjectivities (Burman, 2012). From a decolonial perspective this essentialises the Eurocentric white heteronormative representation as universal (Klein, 2017). This is particularly true of the dominant Western science curriculum and the hegemonic whiteness imbued with the standard accounts of scientific knowledge (Cassiani, 2021). The arguable colonising of childhood innovation is noteworthy within the policy particularly as the concept of innovation is utilised within the developmentalist narratives of the CMP and a noted linguistic apparatus of the OECD's coloniality of knowledge (Hughson, 2024).

Specific mention of challenges that new approaches to curriculum in STEM will need to address are also mobilised. For example, the policy presents the necessity to '[i]ncrease the number of students choosing STEM subjects in post-primary schools, those progressing to STEM pathways in Further or Higher Education and those who take up careers in STEM' (DES, 2017, p. 10). There are four other noted requirements of which this example is representative, and it is noteworthy that the last point raised; to '[e]nsure young people sustain their involvement in STEM education' (DES, 2017, p. 10), is the single instance that does not explicitly reference vocations as core to the rationale for STEM education. These challenges have also been represented in the *Draft background paper and brief for the review of leaving certificate physics, chemistry and biology* (NCCA, 2019), centring a neoliberal rationale within the process of present curricular reforms in science education in Ireland. These official policy discourses therefore

evinced an alignment with the dominant global neoliberal coloniality of curriculum with an intent for greater cohesion to capitalist interests (Fúnez-Flores, 2023) hidden within ostensibly harmless terms, such as ‘innovation’ and ‘career success’. The coloniality of curriculum is especially pernicious given the Western-centric epistemological roots framing the broad discussions of STEM reform. This has international relevance, given the ubiquity which STEM curricula are framed within the neoliberal capitalist model of rationales globally, but also as the discourses exerting the necessity for reform are implicated in the production and preservation of coloniality through the Eurocentric dominance of knowledge and conceptions of education (Fregoso Bailón & De Lissovoy, 2019; Leonardo, 2018). As I will explicate below, this coloniality is implicated within the narratives under which key stakeholders respond to curricula reforms, reinforcing the visage of common sense neoliberal subjectivities.

Recently, there have been multiple governmental calls seeking input on the reform of STEM curricula from stakeholders, as well as an ongoing Joint Committee discussion on *The Future of STEM Education*.⁷ This section will consider some of the extracts from these fora to demonstrate the coloniality of curriculum currently enunciating the cartography of educational possibilities. Of relevance to the present article are discussants seen as core voices in science education at secondary school level in Ireland so I will necessarily restrict my discussion to examples from these.

The Irish Science Teachers Association (ISTA), which is the professional association of teachers of science in Ireland, were represented at the Joint Committee and presented an input on their considerations for the future of STEM education. Their vice-chair argued for the importance of STEM skills, foregrounding their centrality in career-based trajectories, arguing their importance not just in ‘traditional STEM careers’ but as ‘necessary in other fields such as healthcare, finance and even the arts’ (Jones, 2023). The input goes on to reference issues of diversity in STEM fields with the perplexing claim that ‘STEM education provides opportunities to address this imbalance by promoting diversity and inclusivity in STEM related careers’ (Jones, 2023). The essentialising of career exemplars as the path to increasing diversity in STEM education exudes coloniality in presuming the solution is to reinforce the neoliberal enunciation of STEM through tokenistic displays of ethnic sensitivity. This sentiment implicitly resonates with the ways in which neoliberal coloniality implicates subjectivity – or ‘the coloniality of being’ (Maldonado-Torres, 2007). In decolonial theory this concept refers to the manners in which all subjectivities outside the primary enunciation of ‘human’ in the Western world (i.e. white heteronormative males) are innately inferior (Klein, 2017). In presenting a ‘concern’ for minority representation in STEM by suggesting that representing STEM careers as possibly open to minority individuals who have succeeded in the field, the position simultaneously elides the broader injustices in the constitution of STEM by evincing them as benignly constructed and open to minorities. More plainly, ‘you can become like us’. Moreover, it concomitantly disavows pluralities of subjectivities by implicitly suggesting that the manner in which to succeed is to conform to a neoliberal being, thrusting responsibility upon individuals. This seeks to maintain the individualised Manichean frame of subjectivity at the heart of the coloniality of being (Maldonado-Torres, 2007) and the rational individual core to neoliberal ideology. This superficial acknowledgement of diversity is common within neoliberalised tropes of multiculturalism, which in advocating for inclusion for all, diverts attention away from its

evolution as a form of governance technology (Ahmed, 2007) normalising European whiteness of societies (Beebejaun, 2024). As troubling are the implications in the extension of the capitalist desire for more encompassing forms of labour veiled in the conditional inclusion of diverse bodies contingent on assimilation into neoliberal rationalities (Bourassa, 2021).

The ISTA are not alone in conforming to these neoliberalised views of STEM education. The reference to the economic implications for the development of STEM education are replete in submissions to the Joint Committee. However, their claimed issue with current curricular discussions of Leaving Certificate science are dominated by a vexation with a lack of specification of learning outcomes within past draft proposals for new curricula, as well as within the new Junior Cycle Science Curriculum Specification (DES, 2016). This is captured in the organisation's written submission to the joint committee in the claim that their (the ISTA's) view is applicable to all areas of curricula given 'the same flawed template of syllabus design is being used for the reform of all Leaving Certificate subjects'⁸; a finding arising from a report commissioned by the ISTA in response to the then proposed syllabi for sciences at Leaving Certificate level (Hyland, 2014). The crux of the argument centres on the lack of detail provided in specified learning outcomes, both in the present Junior Cycle science curriculum and in draft syllabi for Leaving Certificate science subjects. While the ISTA have conducted research into the concerns of teachers, which should be acknowledged,⁹ my primary concern is with the common-sense acceptance of learning outcomes as an appropriate means of structuring curriculum. The shift to an outcomes-based curriculum mirrors international trends since the 1980s with the intensification of neoliberalism (Fox, 2021) facilitating the embedding of surveillance and results-oriented accountability practices as common sense governance of educational policy (Hardy et al., 2019). These performative cultures are both engendered by and contribute to the coloniality eschewed in globalised neoliberal curricula reforms. In the context of science education specifically, D. V. Smith (2011) argues that the shift to '[o]utcomes-based education [has] lent itself ideally to the fragmentation of community' (p. 1284) by contextualising what is deemed to be good education within a list of measurable statements. Here, the central ideology of rational individualism suppresses potential for an enunciated space of relationality. This once again maintains the coloniality of power of neoliberal capitalism reflected in the neo-conservative flows framing the enunciated position of stakeholders; the ISTA in this case, confined to settling on the ostensible sensibility of outcomes. This demonstrates the true nefarious coloniality of neoliberalism, where in colonising the common sense (Hardt & Negri, 2009) the regime of performativity has in effect instilled an internal biopolitical organisation of key stakeholders (students and teachers alike) towards creating surplus value desired by capitalist expansion via the enclosure of thinking itself (De Lissovoy, 2015).

Put in other words, the coloniality of neoliberalism works through the effective colonising of the minds of educational stakeholders to the point that thinking outside of this system of specified, measurable outcomes seems impossible. Furthermore, recent work by Hyland and Kennedy (2023), key voices in the ISTA, has re-presented the argument once again in a national publication, which is widely circulated and read within the professional community in Ireland, illustrating the vehemence of this narrative. Again, the report draws on the concerns of teachers but is glaring in its absence of discussion

relating to student perspectives. This work goes on to invoke cautions regarding the lack of learning outcome details, received from Andreas Schleicher, head of the OECD's Directorate of Education and Skills (and key motivator of scientific educational provision and research; see Delahunty, 2024), to add validity to the claims that the design of the new science curricula, with less detailed learning outcomes, runs the risk of 'being a mile wide and an inch deep' (Schleicher, cited in Hyland & Kennedy, 2023, p. 199). In this narrative, the coalescing of forces from the OECD, with the predominant concerns from a narrow group of stakeholders of science education, reinforces coloniality of curriculum through the ironic plea not to superficialize the curriculum by further restricting the range of opportunities available to teachers and learners with increasingly neoliberalised, measurable learning outcomes.

Conclusion

This article has argued for the repoliticisation of curricular discourse in science education as a key to combating the pervasive scientism coproductive with the increasing neoliberalisation of contemporary life. I have demonstrated, from a decolonial position, the untenable positioning of scientific knowledge as objective, and the general mechanism by which coloniality of knowledge delineates the enunciation of the 'market' as a frame for curricular cartographies. I have also argued for the effect this has on stakeholder subjectivities and subsequent curricular discourse, showcasing the case of recent debates on science curricula in the Irish context, situated within the larger politics of STEM neoliberalism. This foreclosure of subjectivity, instigated by neoliberal coloniality, is naturalised within the common sense of the 'market' making it appear as if there is no alternative (De Lissovoy, 2015). In the critical analysis considered above, coloniality is manifested through the intertwining of marketized solutions and neoconservative positions, characteristic of neoliberalism (Apple, 2004), which are evinced by key curricular voices such as the ISTA as an example within this contribution. This neo-conservatism is presciently masked within problematised rhetoric denigrating proposed learning outcomes for lack of detail, simultaneously neglecting any consideration of curricular knowledge in science or the neoliberalist inflection of learning outcomes as means of structuring public curricula. The tokenistic focus on diversity in STEM, demonstrated previously, is testament to the biopolitical coloniality achieved by the neoliberal regime, which reinforces a Western-centric episteme of science and the rational self-serving individual of neoliberalism.

The purpose of this analysis is not to assign blame, nor do I direct criticism to any individual in this contribution, but to highlight the coloniality of neoliberalism and its mechanism for enunciation which has reconfigured the subjectivities, and subsequent discourse, of all stakeholders. The critique this paper offers of these positions is not to undermine the body of work that has led to positive transformations in pedagogy and learning within the broader field of science education. Further and arguably, there are some good reasons to include a focus on scientific careers and associated skills in modern school curricula, aligning with Biesta's concepts of qualification and socialisation (Biesta, 2009). However, at present the coloniality of neoliberalism has suppressed the realisation of a broad set of purposes for science education and resulted in an

overemphasis on the area of qualification, narrowly conceived within a miasma of scientific technicism (Vilanova & Martins, 2017).

This critical argument is necessarily incomplete and does not offer solutions but argues for the necessity of reattaching the curricula to a concept of democratic pluralities. While this paper's purpose is an act of unsettlement it is important to reaffirm the ambivalences and sites of resistance that contemporary educational policy does afford, which allows for resistance and reimagining of a public science education oriented to democratic purposes.

Notes

1. 'Heteroactivist' is the term adopted by Nash and Browne (2020) to identify conservative forces working to resist LGBT rights with a contemporary focus where core strategy avoids practices of vilification moving beyond religious arguments and often drawing upon supposedly evidence-based and liberal concerns. Importantly, the term captures the shifting and dynamic strategies and discourses adopted by conservative agendas in opposing equality.
2. Relating to gender, these scientific positions typically draw upon misappropriated scientific evidence suggesting a bimodal reality. Scientism here refers to a blind faith in the modality of scientific rationality as the ultimate arbiter of truth and often leads individuals naively to acquiesce to simplistic or outdated scientific evidence. In this case the biological essentialist position of only two genders is in reality much more complex and recent debates from the biological sciences centre on a conception of the 'bimodal gradient' where interactions of genetic markers social labelled as 'male' or 'female' are present across all living humans. Micah Valentine is an eminent stem cell researcher and activist in radical Black politics and provides a coherent examination of this on a recent episode of *The Malcolm Effect* (<https://kultural.podbean.com/e/92-sex-gender-biology-micah-valentine/>).
3. This figure is according to the most recent coverage in the national census data, recorded by the Central Statistics Office, and as reported by Social Justice Ireland (see <https://www.socialjustice.ie/article/planning-ahead-irelands-demographic-shift>)
4. My use of the term 'public' here in denoting a public form of education does not collapse into a narrow definition of publicly funded education but reflects the complexity and plurality of defining the notion of public. Importantly, my use of this term reflects my commitment to challenging the neoliberal erosion of educational purpose and contains an implicit antithesis to privatised interests, typically manifested in the economic framing of educational discourse, but reaches beyond this dichotomy to consider the nature of the public today and its febrile dynamic and shifting constitution. The notion of public here, therefore, denotes a strong commitment to a pluriversality and inflects a serious consideration and focus on community and relational pedagogic praxis. For more on this see Clarke et al. (2022).
5. <https://m.independent.ie/opinion/analysis/students-ignorance-of-basic-maths-is-sum-of-all-our-fears/26605713.html>
6. The Leaving certificate is the name given to the national secondary/post-primary curriculum in the senior years; typically catering for students ages 15-18. This programme of study culminates in a summative examination, hosted by the state, in each area of study and the results are used as the basis for matriculation to post-secondary education or training, which is typically higher education in the Irish context.
7. The Joint Committees are hosted by the Houses of Oireachtas (Irish Parliament) to debate matters considered significant to Irish society. For the purposes of analysing the coloniality of curricular discourses presently circulating in Ireland these debates are informative as they invite discussants from several sectors of educational stakeholders. In conducting my analysis I have reviewed all debates currently available on the Oireachtas website (links below) but

have been necessarily selective in choosing the representative comments for the discussion presented in this conceptual article. The primary source discussed in this contribution was from the sitting on the 21st March 2023 and can be accessed in full here: https://www.oireachtas.ie/en/debates/debate/joint_committee_on_education_further_and_higher_education_research_innovation_and_science/2023-03-21/3/?highlight%5B0%5D=future&highlight%5B1%5D=stem&highlight%5B2%5D=education

8. See the full ISTA letter of written submission to the Oireachtas Joint Committee here: https://doc-0s-b0-apps-viewer.googleusercontent.com/viewer/secure/pdf/be3ll348l91rbi554i4uac5idmv237dt/fli4snuktqivm5uqbpdc6avcku4knu1f/1695049875000/lantern/13969879869020085909/ACFrOgDSa4IE7B6Q1yxu-grhzJf9ZMHYjWDLlyoogyKXqHKKSE7oEcaCYoa8pJTuwNKrn3Zst-uCyb0gaJxMOJbzodm3sgTBnKUQUIWTtRdT3iV2ub0yvczFWbSYYml1YnGWKD0X_Pz2mFrzs95r?print=true
9. In 2019 the ISTA published a report entitled *Listening to the Voice of Science Teachers* which described teachers' attitudes to current reforms. The results included that 85% of teachers saw the lack of detail provided in learning outcomes within the template for syllabus design as problematic if it were to apply to Leaving Certificate subjects who have the added pressure of the external examination at the conclusion of the programme of study. The full report can be found here <https://ista.ie/jc-science-report/> and further reported in Hyland and Kennedy (2023). This report should however read as uncritical of the present neoliberal milieu and in relation to the dominance of rote learning and teacher-centric pedagogy as published in the TALIS 2009 findings (OECD, 2009) and the further intensification of performativity and accountability cultures influenced by the broader neoliberal erosions of democratic purposes in education. In this light, the fact that teachers are concerned with having greater specification of outcomes mirrors the accountability concerns instilled within neoliberal governance and the increased instrumentalization of educational topographies.

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