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For Whom the Bell Tolls: Mathematics Education in Times of Crisis

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Introduction

We are living in a time shaped by multiple, overlapping crises: e.g., environmental degradation (El Khoury et al., 2025), global pandemics (García-Holgado et al., 2024), economic instability (Carli et al., 2024), enduring social inequalities (Olonisakin et al., 2024), and the ongoing genocide in Gaza, which has exposed cascading crises in international law, human rights protection, atrocity prevention, and genocide scholarship itself (Verdeja, 2026). These crises share, at least in part, common structural conditions. Critical political-economic analyses have argued that capitalist modes of production, global commodity chains, industrial agriculture, ecological degradation, and public-health vulnerabilities are deeply interconnected, such that ecological, epidemiological, and economic crises cannot be fully understood in isolation from one another (Suwandi & Foster, 2020; Wallace, 2016). The ways these crises often intersect and compound one another affect, disproportionately, marginalised communities (Maestripieri, 2021; Pitzalis & Porcu, 2024). Within this context, the role of mathematics warrants renewed scrutiny, not only for how it represents the world, but for how it actively shapes it.

Recently, Ole Skovsmose (2021) offered a compelling framework for understanding how mathematics relates to crises. He proposed that mathematics can constitute a crisis, by being embedded in systems that generate harm; picture a crisis, by modelling and representing it; or format a crisis, by shaping how it is understood and acted upon. This typology challenges the widespread view of mathematics as neutral and objective by emphasising its performative and political functions. Although Skovsmose briefly acknowledged the relevance of these categories for mathematics education, his analysis focuses primarily on mathematics as it operates within broader societal structures, for example in epidemiological forecasting, economic systems, and environmental modelling. In contrast, this essay places mathematics education itself at the centre of analysis.

To clarify from the beginning, I do not use *mathematics education* as an undifferentiated umbrella term. Rather, I treat it as an institutional and discursive field comprising, inter alia, four analytically distinct but interrelated focal dimensions: mathematics education research, classroom teaching/learning practice, mathematics teacher education, and policy/curricular governance. These dimensions do not operate in the same way, nor are they implicated in crises in identical manners. However, each provides a site through which mathematics education may participate in constituting, picturing, or formatting crises.

The originality of this essay lies in shifting the analytical focus from mathematics as social technology to mathematics education as an institutional, pedagogical, and discursive field implicated in crisis. Building on work that shows how mathematics models organise, and legitimise crises, the essay examines how mathematics education participates in these processes through curriculum, pedagogy, assessment, teacher education, research agendas, and policy regimes. It reconstructs Skovsmose's typology for mathematics education by showing how the field may constitute crises through exclusionary structures and pedagogical norms, picture crises through data-rich and modelling-based engagements with urgent social issues, and format crises by shaping what is regarded as a problem, thereby requiring a solution and a legitimate response.

In developing this argument, the essay draws on the field of critical mathematics education, which interrogates the social, political, and ethical dimensions of mathematics teaching and learning (Skovsmose, 1994; Ernest, 2019). Prior research has shown how mathematics can reproduce dominant ideologies, marginalise alternative knowledge systems, and reinforce patterns of social stratification. Work on social justice mathematics (Frankenstein, 1983; Gutstein, 2016), curriculum politics (Gutiérrez, 2018; Valero, 2004), and the ethics of modelling (Barwell, 2013) informs this inquiry. Recent contributions by Appelbaum et al. (2022) have begun to consider how mathematics education might engage in the picturing, constituting, or formatting of crises. Building on their insight, this essay develops a more structured reinterpretation of Skovsmose's (2021) categories for the field of education.

In the sections that follow, I examine each of the three categories (constituting, picturing, and formatting) through a theoretical analysis and illustrative examples. I conclude by exploring the implications of this reframing for curriculum, pedagogy, and educational research in an era increasingly defined by crisis.

Mathematics education as constituting a crisis

If mathematics can be part of what *constitutes* a crisis, embedded within the systems, algorithms, and practices that bring crises into being (Skovsmose, 2021), then we must ask whether mathematics education can also play such a role. To say that mathematics education participates in constituting a crisis is not to treat it as an autonomous agent or sole cause, nor to displace responsibility from the political-economic actors, institutions, and social classes that organise and benefit from unjust conditions. Rather, it is to examine how the structures, practices, and ideologies of mathematics education become implicated in producing, legitimising, or sustaining harmful arrangements. This challenges the common view of education as a benevolent or neutral force, and instead invites scrutiny of the ways schooling – and school mathematics and its associated practices in particular – can mediate wider social relations, sometimes generating, entrenching, or exacerbating crises, especially for marginalised populations. The point, then, is not that mathematics education is either inherently harmful or emancipatory, but that its effects are the consequence of the social relations, institutional arrangements, and political projects within which it is embedded.

Crisis through exclusion and stratification

One of the most visible ways in which mathematics education may participate in constituting a crisis is through its role in legitimising educational gatekeeping and reproducing social inequality. In many national contexts, school mathematics operates as a 'gatekeeping' subject: high-stakes examinations in mathematics determine access to academic pathways, university programmes, and employment opportunities (Bennett & Lai, 2025; Douglas & Attewell, 2017). The problem is not only that such gatekeeping disproportionately affects particular groups, but that gatekeeping itself can function as a political mechanism for managing scarcity. In contexts marked by austerity, economic restructuring, privatisation, or the erosion of public provision, mathematical tests and credentials can be used to allocate limited opportunities while presenting exclusion as the outcome of individual merit or failure. This gatekeeping function is frequently justified as a 'fair' and 'objective' measure of ability. However, such claims of fairness may obscure the wider social and economic conditions in which pupils are made to compete for increasingly constrained educational and employment opportunities. In this sense, mathematics education can shift attention away from the structural causes of exclusion and toward individual performance: unemployment, blocked mobility, or restricted access come to appear as the consequences of failing mathematics, rather than as effects of political-economic arrangements that produce and normalise competition over limited educational places, secure employment, public goods, and social mobility. Research consistently shows that attainment in mathematics is strongly associated with socio-economic status, linguistic background, ethnicity, and gender, factors that go beyond individual aptitude or effort. As a result, mathematics often functions as a sorting mechanism that reinforces pre-existing hierarchies (Hoadley, 2007; Lubienski, 2002). For instance, work from European contexts, including the UK (Gates, 2019) and Norway (Khilji & Xenofontos, 2024), has highlighted how, for pupils from under-resourced schools, low socioeconomic backgrounds, ethnic minority communities, or immigrant families, mathematics can become a site of alienation, failure, and exclusion. In this way, educational systems themselves contribute to the wider social crisis of inequality not only by distributing opportunities unequally, but also by legitimising the very terms on which scarcity, competition, and exclusion are organised (Leyva et al., 2021; Pomeroy et al., 2024).

Inequalities are not only evident in outcomes but also embedded in the content and pedagogy of mathematics. Curricula that focus narrowly on abstract procedures and standardised algorithms can marginalise pupils' cultural knowledge, lived experiences, and alternative ways of reasoning (le Roux & Swanson, 2021). In many classrooms, 'mathematical ability' is defined in terms of speed, accuracy, and compliance, qualities that may align more with institutional schooling culture than with deeper mathematical thinking (Boaler, 2015; Makrakis, 2021). Such a narrow framing can foster disengagement and even identity crises among pupils who do not see themselves reflected in the discipline or the classroom (Foyn et al., 2018; Xenofontos, 2024a). Consequently, patterns of this kind amount to a form of epistemological injustice: the system(at)ic devaluation of certain forms of knowledge, experience, and identity. More importantly, these injustices are not incidental side effects of a flawed system but are often constitutive features of how mathematics is taught and institutionalised (Mijs, 2016; Tan & Dimmock, 2022; Valero, 2010).

Technocracy and the hidden crises of mathematics education

A less visible form of crisis in mathematics education arises from the normative construction of what counts as valid knowledge (Durand-Guerrier, 2008; Rittle-Johnson, 2017). Contemporary curricula, particularly under the influence of STEM priorities and data-driven policy, privilege epistemic values such as rationality, objectivity and control (Barcelona, 2014; Sharma & Hudson, 2022; Slaton, 2015). While precision, efficiency and optimisation are undeniably valuable, presenting these as universally superior modes of thought risks fostering a technocratic worldview that holds the belief that all problems are solvable through calculation, regardless of their human or ethical dimensions. This framing can itself produce a crisis. Sidestepping the moral, cultural and political complexities of social and environmental problems by framing them as optimisation tasks, such as minimising costs, maximising efficiency or allocating resources "rationally", conditions pupils to overlook such considerations

(Ernest, 2018). De Freitas (2008), for example, discusses a modelling task in which pupils are asked to advise a resort committee on how to wash away a mountain on a South Sea island, using fire-fighting ships, “as quickly as possible” (p. 83). She argues that although the task is mathematically open-ended, its framing is ethically narrow: it places the pupil in the role of a businessperson or engineer to serve the resort committee, while environmental and political questions, including the likely damage to marine life, are excluded from the problem’s preferred solution. De Freitas therefore proposes that such a task could be made more critical by requiring pupils to consider competing perspectives, for instance by modelling both the resort committee’s interests and those of an island environmental committee. Her example shows how mathematical modelling tasks can invite pupils to inhabit particular positions of power: in this case, to reason as advisers to a resort committee whose goal is to remove part of an island as efficiently as possible. The ethical problem is therefore not simply that values are hidden beneath a supposedly neutral task, but that the task itself organises pupils’ mathematical activity around a damaging objective while excluding environmental and political consequences from the preferred solution path. Such tendencies exemplify Skovsmose’s (2020) concept of the *banality of mathematical expertise*, in which mathematical reasoning becomes a taken-for-granted basis for decision-making, obscuring ethically fraught assumptions and legitimising dehumanising or environmentally harmful outcomes. The persistence of these tendencies contrasts sharply with what Wallin et al. (2025) term *mathemat-ing* (that is, open-ended, relational, and ethically responsive mathematical encounters in which pupils may engage or even refuse without penalty), a practice that, by its very difference, exposes the narrowness and potential harm of the prevailing model.

Neoliberal institutions and the political economy of crisis in mathematics education

Educational institutions that teach mathematics are not neutral venues for transmitting knowledge; they are embedded in political economies whose logics increasingly reshape their purpose. Neoliberal, austerity-driven and privatising reforms have reoriented mathematics towards the production of "human capital", subjecting its ethical, cultural and democratic dimensions to the demands of market competition. This reorientation masks the structural dismantling of public education through chronic underfunding, privatisation and policy centralisation by recasting systemic inequities as individual or cultural shortcomings (D'Souza, 2023). In doing so, it legitimises practices and technologies that commodify mathematics, from subscription-based learning platforms to marketised curriculum materials, embedding values of efficiency, competition and individualism into everyday pedagogy (Darragh, 2021; Lee, 2023). Policy regimes such as England's "Teaching for Mastery" exemplify how neoliberalism couples with neoconservatism to impose narrow curricular frameworks that produce compliant mathematical subjectivities while claiming to raise standards (Pratt & Alderton, 2023). These same dynamics intersect with racialised and classed hierarchies, rendering certain pupils, classrooms and schools expendable, thereby reinforcing stratification as a structural requirement of the system (Sengupta-Irving, 2021). In this way, mathematics education does not respond to social and economic crises, but actually generates them, shaping subjectivities, deepening inequalities and constraining the social imagination of what mathematics can be.

Another constitutive dynamic lies in the structure of educational systems, particularly the dominance of standardisation, accountability regimes and performance metrics. International assessments such as PISA and TIMSS have been influential reference points in mathematics education discourse and comparative studies, shaping conversations about curriculum content and, in some contexts, informing policy priorities (Andrews, 2012; Rubel et al., 2022). While these frameworks are often promoted as tools to raise standards, similar reforms are frequently mobilised through “crisis” narratives that legitimise the pursuit of uniform benchmarks and heightened accountability (Lewis et al., 2020; Yeh, 2018). In England, for instance, neoliberal and neoconservative influences have combined to produce a high-stakes testing culture that encourages “teaching to the test” and limits opportunities for creativity and deeper conceptual engagement in mathematics (Pratt & Alderton, 2023). This culture is underpinned by national and commercial assessment tools that, as Breadmore and Carroll’s (2021) review of norm-referenced tests illustrates, set achievement against standardised, quantifiable measures. It is further reinforced by the expansion of commercial online mathematics platforms (Darragh, 2021) and integrated digital management systems (Selwyn, 2011) that embed performance tracking and monitoring into everyday schooling. In such high-pressure contexts, mathematics can become a source of stress and disengagement, with classroom activity shifting from exploration towards surveillance and ranking. This emphasis on procedural performance over mathematical reasoning and proof (Andrews, 2012) risks alienating learners, narrowing critical thinking and reducing the subject’s educational and emancipatory potential.

Mathematics education as picturing a crisis

To say that mathematics education can picture a crisis is to suggest that the teaching of mathematics can act as a lens through which pupils observe, describe, and make sense of real-world problems. This aligns with Skovsmose’s (2021) notion of mathematics as *picturing* (or modelling) a crisis, by providing simplified representations of complex realities. When applied to educational contexts, this concept points to pedagogical practices in which teachers draw on real-world data, contexts, and phenomena as entry points for mathematical learning. In such

cases, crises such as climate change, pandemics, income inequality, or social injustice are not treated as peripheral issues but become central components of the curriculum. Through the use of data analysis, statistical reasoning, mathematical functions, and modelling activities, pupils engage with urgent social and environmental issues using mathematical tools.
This pedagogical orientation is reflected in a range of frameworks, including social justice mathematics (Frankenstein, 1983; Gutstein, 2016), realistic mathematics education (Gravemeijer & Doorman, 1999), and critical mathematical literacy (Skovsmose, 1994). The goal is not merely to increase the relevance or engagement of mathematics, but to empower pupils to understand – and potentially intervene in – the world they inhabit. Building upon Freire (1970), Frankenstein (1983), Skovsmose (1994) and others, Gutstein (2018) refers to *reading* and *writing* the world with mathematics: "to use and learn mathematics to study social reality, as a way to deepen learners' understanding of the roots of injustice and to prepare them to change the world, as they see fit, in both the present and future" (p. 133). In this spirit, mathematics education that pictures crises positions mathematics as a tool for interpreting, questioning, and responding to the conditions of the world.

Examples of crisis-picturing approaches

During the COVID-19 pandemic, educators in schools, universities, and teacher-training programs turned to real-time epidemiological data to help pupils make sense of the crisis as it unfolded. Public datasets such as daily infection counts, reproduction numbers (R values), and vaccination rates became teaching tools for topics like exponential growth, logarithmic scales, data visualization, and statistical inference (da Silva et al., 2021; Delport, 2021; Lugo-Armenta & Pino-Fan, 2021). Many lessons featured authentic graphs from health agencies and news dashboards, using them not just to track trends but also to model possible scenarios and spark conversations about the social implications of mathematical findings. This approach reflects research showing that mathematics and statistics education can build the critical literacy needed to interpret high-stakes public health information (Adkins, 2023; Sooknanan & Seemungal, 2023). Still, studies reveal that many people struggle to read pandemic graphs, often misinterpreting cumulative curves or underestimating exponential growth, which shows the importance of teaching visualisation literacy explicitly (Delport, 2021; Sooknanan & Seemungal, 2023). Combining standard graphs with more creative, multimedia visualisations from journalism could further enrich pupils' mathematical understanding and encourage informed civic engagement during crises (Lim et al., 2023).

The climate crisis has prompted a similar approach. Mathematics educators often bring real-world environmental data into the classroom, encouraging pupils to investigate the causes, consequences, and possible solutions to global warming. Public datasets such as long-term temperature anomalies, atmospheric CO_2 levels, and fossil fuel emissions provide the raw material for lessons on measures of central tendency and variability, modelling, non-linear systems, and statistical inference (Barwell, 2013; Coles et al., 2013). Authentic graphs from the Intergovernmental Panel on Climate Change (IPCC) and national meteorological services are used to track long-term patterns, compare regions, and explore uncertainties in climate modelling (Steffensen et al., 2021; Tasquier et al., 2016). Such teaching illustrates the "formatting power" of mathematics, the way it shapes how we see climate change by structuring the evidence and framing particular narratives (Barwell, 2013). Yet this formatting power also concerns attribution. Climate data do not simply show that warming is occurring; they can also be used to ask which industries, states and institutions are disproportionately responsible, and which actors benefit from particular framings of the crisis. The Carbon Majors research, for instance, traces a large share of historical fossil-fuel and cement emissions to a relatively small number of corporate and state producers

(InfluenceMap, 2024). Research on military emissions similarly identifies the US Department of Defense as an exceptionally large institutional consumer of petroleum, making militarism and military logistics relevant to climate accounting (Crawford, 2019). Arctic warming also raises questions about benefit and extraction, as melting ice has been linked to new shipping routes, intensified resource frontiers and environmental conflicts (Hanaček et al., 2022). A critical mathematics education approach would therefore ask pupils not only to model atmospheric change, but also to compare producer and consumption-based, national, corporate and military emissions accounts, and to consider how each framing distributes responsibility differently. Research also stresses the importance of critical engagement, helping pupils question how modelling assumptions affect predictions or using estimation activities to challenge misconceptions with surprising numerical evidence (Thacker, 2023). As with pandemic data, teaching climate change requires explicit attention to visualisation and modelling skills, ideally within interdisciplinary work that connects mathematics to science, policy, and civic action (Li, 2025; Oikonomou, 2025). In this way, mathematics can equip learners not just to interpret climate data, but also to assess proposed solutions, identify patterns of responsibility and benefit, and take part in meaningful debate on one of the defining issues of our era.

Mathematics has also been used to examine financial and economic crises, enabling pupils to investigate inequality, debt, poverty, and potential remedies. Public indicators such as unemployment rates, inflation, housing affordability indexes, and income distribution statistics provide entry points for learning about percentages, ratios, compound interest, budgeting, and economic modelling (Cavalcante & Savard, 2022; Jayaraman et al., 2018; Ozkale & Aprea, 2023). Lessons might draw on real-world cases from the 2008 mortgage/global financial crisis to pandemic-era income loss, blending technical skills with critical financial literacy so that pupils understand not just the numbers, but also the systems behind them (Cavalcante

& Savard, 2022). This approach mirrors research calling for the integration of mathematics, financial literacy, and social justice, giving pupils the tools to question how economic structures shape access to resources and opportunities (Gutstein, 2016; Tanase & Lucey, 2015). Activities often involve horizontal mathematisation, which means moving between real-world contexts and abstract models to analyse and validate representations of economic realities (Botha & van Putten, 2018). For example, pupils might break down predatory lending practices through amortisation tables, model the long-term effects of wage gaps, or compare debt burdens across income levels. Such tasks combine classical mathematics with critical readings of society. Studies also point to the value of grounding this work in culturally relevant contexts, especially for pupils from communities disproportionately affected by economic marginalisation (Gutstein, 2016; Esmonde, 2014). As with teaching other crises, lessons on economic instability work best when they combine explicit training in reading graphs, tables, and models with interdisciplinary perspectives that connect mathematics to economics, politics, and civic engagement, helping learners navigate their own financial decisions while contributing to broader efforts for economic justice.

Mathematics education as formatting a crisis

If constituting a crisis means helping to create or sustain it, and picturing a crisis means representing it, then formatting a crisis is about how mathematics – and mathematics education – shape how crises are understood, valued, and addressed. As Skovsmose (2021) notes, mathematics has performative power: it does not simply reflect reality, but actively structures the possibilities for action. In education, formatting means that school mathematics is never neutral (Gutiérrez, 2017). The choice of problems, the selection of data, and the solutions considered acceptable all influence how teachers and learners perceive crises and their roles within them. To realise its emancipatory potential, crisis-formatting mathematics classrooms should encourage critical reflection by asking questions such as: Where do these data come from? What is omitted? Who benefits from this framing? What alternatives exist? (Esmonde, 2014; Lim et al., 2023; Thacker, 2023). Such inquiry turns the classroom from a place of passive learning into one of active critique, enabling pupils to represent, analyse, and act on crises. Formatting a crisis is never just descriptive. It defines what is considered relevant, valuable and therefore solvable. Every mathematical representation carries this latent formatting power. Making this visible allows teachers and learners to see how mathematics influences not only how a crisis is measured, but also how possible solutions are imagined (Skovsmose, 2021).

From ethical formation to the politics of definition

Beyond its role as a matter of technical framing, formatting is also a process of shaping dispositions toward the world. In mathematics education, repeated encounters with particular types of problems, modes of reasoning, and norms for acceptable solutions gradually foster implicit values that begin to feel natural through everyday practice (Atweh, 2013; Boylan, 2016). These include privileging quantifiable outcomes over qualitative considerations, framing optimisation as inherently desirable, elevating abstraction above contextual understanding, and treating trade-offs between efficiency and equity as normal features of decision-making. When such orientations are taught without explicit ethical reflection, they risk becoming invisible frameworks that shape how pupils perceive legitimate action and judgment (Radford, 2023). For example, as discussed earlier, school 'real-life' applications in mathematical modelling often require pupils to maximise efficiency or profit in contexts such as infrastructure projects or resource allocation, without addressing whose interests are prioritised, what harms are excluded from consideration, or how environmental and social costs should be weighed (de Freitas, 2008). While presented as neutral skill-building, such activities can normalise a technocratic rationality that treats human, ecological, and cultural factors as interchangeable variables in an optimisation model (de Freitas, 2008; Radford, 2023). In crisis contexts, mathematics education does not operate in an ethical vacuum. Rather, it can legitimise trade-offs that privilege dominant interests while marginalising vulnerable communities. For example, a unit on probability, statistics, or linear modelling might ask pupils to interpret crime data, estimate risk, or allocate police resources to areas with higher predicted crime rates. Treated only as a technical exercise, the task can encourage pupils to see prediction, optimisation, and efficient allocation as neutral mathematical goals. Yet research on predictive policing shows that such models do not simply represent crime patterns. They help materialise certain people and places as "risky" by drawing on historically unequal data, prioritising particular indicators, and directing police attention accordingly. The resulting interventions can then generate further data that appear to confirm the original classification. In this way, the model does not stand outside the reality it measures; it participates in producing the very field of risk it claims to describe (Hälterlein, 2021; Završnik, 2021). The problem, then, is not probability theory itself, but the absence of ethical reflection on what is counted, whose experiences are excluded, and how mathematical authority can legitimise unequal interventions. Teaching *dominant* mathematics (i.e., the mainstream, institutionally sanctioned form of mathematics rooted in Western epistemologies and positioned as universally applicable) without a reciprocal ethical engagement conditions learners to view certain knowledge systems as inherently superior (Abtahi, 2022). Over time, this can erode the cultural and epistemological resources of non-Western communities, normalising forms of harm as unavoidable or acceptable (Luecke et al., 2022).

Formatting also operates upstream, in determining which situations even qualify as *crises* within the mathematical imagination. Every decision about curriculum content, including the choice of datasets, modelling scenarios and case studies, signals to pupils which problems are worthy of quantification and which fall outside the purview of mathematics. If climate modelling, pandemic projections or GDP downturns are frequent topics, but housing insecurity, racialised policing or settler colonial land dispossession are absent, the implicit lesson is clear: selected realities are legitimate objects of mathematical scrutiny, while others are rendered "non-mathematical" or peripheral. This is not a matter of incidental omission; it is a process of boundary making that arranges the geography of concern. Such boundaries often reflect entrenched patterns of world power sustained by coloniality and globalised imaginaries of citizenship, where western epistemologies and contexts are placed at the centre while those beyond are rendered invisible (Chronaki & Yolcu, 2021; Fernandes et al., 2022). Moreover, the distribution of attention frequently mirrors geopolitical asymmetries: crises in the Global North may be examined with fine-grained data, while those in the Global South appear only as aggregated statistics or abstract exemplars. This structural inequality aligns with the observation that equity research in mathematics education remains dominated by Global North perspectives, limiting the visibility of Southern contexts and priorities (Vithal et al., 2024). Eurocentric framings of mathematics education can further marginalise local knowledge systems and diminish the legitimacy of crises rooted in non-Western experiences (Olawale, 2025). Such patterns reinforce global hierarchies of urgency and visibility, subtly teaching pupils which lives and contexts merit analytic detail. Through these curricular choices, mathematics education helps construct what Skovsmose (2021) calls the "politics of crises", legitimising certain framings while marginalising others, not by argument but by habituation. The result is a patterned attentiveness: a readiness to model and act on some crises while remaining inert or indifferent to others. In this way, the mathematics classroom becomes a site where the authority to define and prioritise knowledge is both exercised and contested (Appelbaum, 2022), making the politics of inclusion and exclusion a constitutive feature of what constitutes a crisis.

Finally, formatting shapes the repertoire of actions that pupils learn to associate with a crisis. Analyses of mathematics classroom discourse in different contexts show that teachers' language frequently encodes procedural obligations and directive authority (e.g., "you have to…", "we need to…"), emphasising actions such as performing calculations or following set procedures. Opportunities for pupils to engage in collaborative sense-making, open deliberation, or critical questioning are comparatively rare in such discourse (Herbel-Eisenmann & Wagner, 2010; Ng et al., 2021; Schleppegrell, 2007; Wagner & Herbel-Eisenmann, 2008). When crises are framed primarily as analytical challenges, pupils may become adept at describing them yet lack the tools or the perceived mandate to participate in their transformation. This is not reducible to individual teacher choices; it is often a structural feature of how mathematics is positioned in schooling. Classrooms are rarely organised as sites for confronting power or imagining alternatives; instead, they tend to reward compliance, procedural fluency, and the correct reproduction of established methods (Gutiérrez, 2013; Xenofontos, 2024b). In such environments, crisis-oriented mathematics can end up reinforcing passivity: pupils learn to produce technically correct representations without engaging with the social processes that could change those realities. Reimagining this terrain requires expanding the conception of mathematical agency. Pupils should encounter opportunities to question dominant models, experiment with alternative framings, and consider the downstream implications of their analyses. They should practise translating quantitative insights into forms of civic action, whether through community engagement, policy critique, or collaborative problem-solving. By integrating these capacities, mathematics education could shift from merely formatting how crises are perceived to enabling collective capacities for how to contest them.

Implications and future directions

Reinterpreting Skovsmose's typology of picturing, constituting and formatting in relation to mathematics education indicates that the subject is not merely a technical discipline but also a formative social practice. This reframing shifts the conversation from asking how mathematics education can respond to crises to asking how it is already implicated in them. The implications are significant for curriculum design, classroom pedagogy and educational research.

First, acknowledging that mathematics education can *constitute* crises calls for a systemic lens. Practices such as high-stakes testing, narrow curricular hierarchies and deficit-oriented pedagogy may perpetuate exclusion and social stratification (Douglas & Attewell, 2017; Hoadley, 2007; Lubienski, 2002). Addressing this is not a matter of raising standards within the existing framework. It involves rethinking the very organisation of school mathematics: who defines its purposes, whose knowledge is legitimised, and how structural inequities are reinforced through assessment and policy (Valero, 2010).

Second, recognising mathematics education as *picturing* crises affirms the value of embedding socially urgent contexts such as climate modelling, public health data or income inequality within mathematical learning (Gutstein, 2018; Barwell, 2013). Doing so can increase relevance and engagement, but it also requires careful critical framing. Teachers must guide pupils to interrogate modelling assumptions, recognise what is omitted, and explore the ethical and political stakes of quantitative representations (Sooknanan & Seemungal, 2023). Without this reflexive component, crisis-themed lessons risk reproducing technocratic certainty rather than fostering critical literacy.

Third, understanding mathematics education as formatting crises invites a broader ethical and political remit for the subject. Mathematics classrooms are not neutral spaces of skill acquisition. They cultivate dispositions, legitimise particular forms of reasoning and define what counts as a problem worth solving (Radford, 2023). For example, work on climate change in mathematics classrooms might involve interpreting temperature graphs, comparing emissions data, or modelling possible future scenarios. However, such tasks can also invite pupils to examine uncertainty, conflicting interests, unequal vulnerability, and the limits of mathematical prediction in deciding how societies should respond to climate crisis. Abtahi et al. (2017) argue that because mathematics is central to communicating, predicting and working with climate change by including it in mathematics classrooms can be understood as an ethical responsibility. Curriculum decisions are also decisions about whose lives, contexts and futures matter. Embedding ethical inquiry, multiple epistemologies and civic engagement into mathematics education can disrupt inherited patterns of exclusion (Abtahi, 2022) and challenge Eurocentric or colonial framings of crises (Fernandes et al., 2022).

The framework opens several avenues for inquiry. Empirical classroom studies could examine how crisis-oriented mathematics lessons influence pupils' perceptions, agency, and ethical reasoning. Curriculum analyses might investigate which crises are represented, which are ignored, and how these patterns reflect geopolitical or epistemological biases (Fernandes et al., 2022). Teacher education research could explore how to prepare educators for the intellectual, ethical, and political challenges of teaching crisis-related content. Comparative and cross-cultural studies could examine how mathematics curricula across different systems foreground, marginalise, or omit particular crises, thereby revealing how curricular framings are shaped by geopolitical location, colonial histories, and epistemic hierarchies, and opening possibilities for decolonising and diversifying mathematics education (Shahjahan et al., 2022). The pressing task is to develop a mathematics education that recognises its own entanglement with crisis while equipping learners to challenge and transform the systems that sustain it. This means moving beyond access and equity in the narrow sense towards a vision of mathematics education as a site of critical engagement, ethical reflection, and collective action (Gutstein, 2018; Radford, 2023). A crisis-conscious pedagogy would enable pupils to read the world mathematically and, crucially, to reimagine and reshape it, bringing mathematics into the service of more just and sustainable futures.

Concluding thoughts

This essay has extended Skovsmose's (2021) typology of mathematics as constituting, picturing, and formatting crises to the domain of mathematics education, demonstrating that these roles are not peripheral but embedded in its everyday practices. Mathematics education can illuminate pressing social, environmental, and economic problems, but it can also participate in their reproduction, consequently restricting how they are imagined and contested. These functions are realised through the integration of real-world contexts, the structuring effects of institutional arrangements, and the epistemic framing of what qualifies as a legitimate problem and solution. Recognising this entanglement foregrounds the need for pedagogical and policy approaches that are reflexive, inclusive, and oriented towards justice. Importantly, mathematics education is already making steps in this direction. Recent international activity, including the 27th study of the International Commission on Mathematical Instruction (ICMI) on *Mathematics Education and the Socio-Ecological*, indicates that the field is increasingly attending to the entanglement of mathematics education with contemporary social, political, ecological, and planetary crises (Le Roux et al., 2025). Similarly, the 74th conference of the International Commission for the Study and Improvement of Mathematics Teaching (CIEAEM), *Mathematics and practices: Actions for futures*, signals a growing concern with how mathematical practices may contribute to imagining and acting toward different futures (Björklund Boistrup & Di Paola, 2024). Further evidence of this shift can be seen in the forthcoming 15th Congress of the European Society for Research in Mathematics Education (CERME15), to be held in 2027, which will include a new Topic Working Group titled "Exploring Socio-Ecological Dimensions of Mathematics Education in Times of Change". These developments do not contribute in resolving the tensions examined in this essay, but they show that the field is beginning to organise sustained scholarly conversations around them.

In a world facing overlapping ecological, political and economic breakdowns, mathematics education cannot retreat into a stance of neutrality. It has to confront its own part in these crises, and its potential to help people respond to them. This means creating classrooms that are reflexive, participatory and justice-focused (Gutstein, 2018), where learners are not only taught to solve problems but to ask who defines them, who benefits from their solutions, and whose voices are missing (Abtahi, 2022). If we can make mathematics classrooms places where pupils read the world with a critical eye, question what they are given, and imagine other futures, then mathematics education can stop being a silent witness to crises and become an active force for change. That shift will not happen without the intention to make it. As Skovsmose (2021) reminds us, it is the defining challenge for mathematics education in our time, and meeting it will take not just new ideas, but determination, care and a willingness to act.

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