Title: Is UNESCO's Guidance for Generative AI (GenAI) in Education & Research "The Solution" to the problem of GenAI adaptation in international schools? A critical analysis of policy recommendations through Carol Bacchi's *What's The Problem Represented to Be?* (WPR) Framework.

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Abstract

The rapid development of generative AI (GenAI) technology is having a wide-ranging, often unpredictable impact on education, presenting a dynamic "unfixed problem" that requires adaptation through policy development and implementation at national and institutional levels. This paper presents a critical analysis of UNESCO's 2023 *Guidance on generative AI in education and research* ("The Guide"), the first internationally-published set of policy recommendations for education, from the perspective of international schools. An interpretation of Carol Bacchi's "*What's the problem represented to be?*" (WPR) framework of poststructural analysis is applied to the text, opening space for discourse on the potential utilities, limitations and implication of UNESCO's recommendations. This analysis interrogates the problem representation of the need for policy guidance, surfacing assumptions around UNESCO's "human-centred" approach to GenAI adaptation and identifying 'quiet silences', alternative problem conceptualisations and potential effects of implementation of the recommendations. It is concluded that although The Guide provides a suitable starting framework for policy development, local contextualisation and evaluation need to be carefully considered in its application in diverse international education settings, to ensure that the discursive, subjectification and lived effects of the recommendations effectively reflect inclusive, equitable and ethical outcomes.

Contents:

I. Introduction

Since the release of OpenAI's ChatGPT in November 2022, generative AI (GenAI) has been having significant impacts on education (Tuomi, 2023; Mills, Bali and Eaton, 2023; UNESCO, Miao and Holmes, 2023), with the technology and its uses developing more quickly than educational systems and policy have been able to adapt (UNESCO, Miao and Holmes, 2023). Although AI in education (AIEd) has been a field of research and study since before the 1980s (Holmes, 2019), ChatGPT's release represents a tipping point for non-expert users, through the application of user-friendly *natural language processing* (NLP) to *large language models* (LLM's), allowing users to create novel outputs using (primarily English) prompts, without the need for coding expertise or even a working understanding of the underlying principles of AI. As a "subcategory" of wider research and development in AI (see Fig 1), GenAI's proliferation into mainstream use has become a widespread source of opportunity and concern.

Although ChatGPT was "the fastest-growing consumer application in history" (Hu, 2023), "driven by the fact that it was free to access, available to individuals, and incredibly useful" (Mollick, 2024, p.xvi) and has potentially become synonymous with GenAI, 2023 has seen the release of competing LLM's, including proprietary tools for Google and Anthropic, and a growing number of open-source models, including those built in languages other than English. Within the subcategory of GenAI, LLM's represent just one area that has developed in relevance to education, with image, video and audio generation all now readily available to public users. With GenAI becoming a major focus of competition in technology and educational technology (edtech) development, the proliferation of GenAI capabilities in tools accessed by teachers and students is increasing, with features enabled in many platforms that are not explicitly labelled as "AI" (Taylor, 2023a). The pace and scale of these developments create regulatory and policy challenges for governments, agencies and educational institutions.

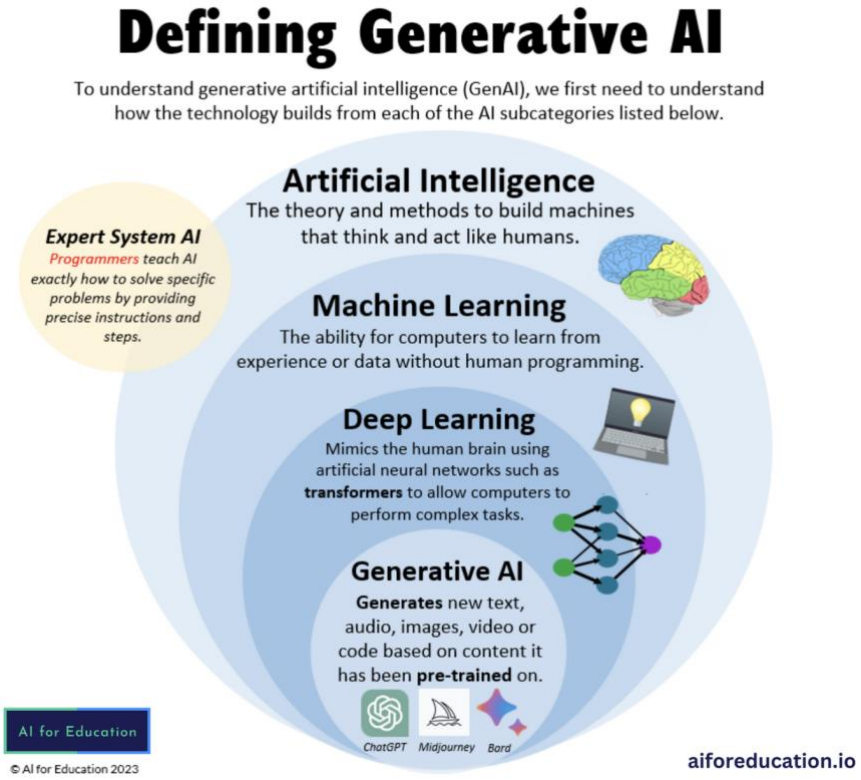

Fig 1: Generative AI Explainer (2023), from https://www.aiforeducation.io/ai-resources/generative-ai-explainer. Generative AI is a small subset of AI research and development. (Distol, 2023)

Despite the potential of GenAI to enhance education and research, there are significant ethical and safety concerns associated with it, including bias, privacy, data security, misinformation, job displacement, intellectual property and environmental costs (Furze, 2023). This rapid introduction of poorly-understood technologies into educational spaces creates both opportunities and challenges for learning institutions, which have struggled to keep pace with these innovations (Carrigan, 2023; Mills, Bali and Eaton, 2023; Wang et al., 2023), with more recent evidence starting to emerge on potentially deleterious effects to learning of over-reliance on GenAI (Abbas, Jam and Khan, 2024). Striking the balance between innovation and ethical adaptation presents a critical challenge for education as institutions aim to prepare their graduates for future success without causing harms or further exacerbating systemic inequalities.

GenAI has moved beyond a technical challenge or curiosity: "recasting it as a public problem offers new avenues for action," and "a system of relationships between people and machines that creates language, makes mistakes, and needs to be systematically cared for."(Ananny, 2024). Framing GenAI as a public problem opens the discourse to be "collectively debated, accounted for, and managed (...) not the purview of private companies or self-identified caretakers who work on their own timelines with proprietary knowledge." (ibid). To this end, reliable and practical guidance on policy and implementation is required as a framing for discourse and policy development.

As Mollick (2024, p.43) notes, "the path forwards requires a broad societal response, with coordination among companies, governments, researchers and civil society. " The September 2023 release of UNESCO's "Guidance on Generative AI in Education and Research" ("The Guide") aims to fulfil that need through policy recommendations (UNESCO, Miao and Holmes, 2023). Through this paper I will critically analyse the recommendations of The Guide through discussion of "policy as discourse" (Ball) and the application of Carol Bacchi's "What's the Problem Represented to Be?" (WPR) framework. I discuss the origins and development of The Guide, through the structure of the WPR questions, with the precursor question *"Is UNESCO's Guidance for Generative AI (GenAI) in Education & Research "The Solution" to the problem of GenAI adaptation in international schools?"*.

The focus on international education is intentional as an area of personal expertise, as well as a field in which educational innovation can thrive, and within which the diversity of students, teachers and approaches can be seen as a model of many of the practical and ethical issues raised by the emergence of GenAI. Through this analysis, I discuss the strengths, limitations and potential applications of The Guide, with a focus on international education settings, and give recommendations for further research and development.

Researcher Positionality & Context

This paper is written from my perspective as Director of Innovation in Learning & Teaching at a leading International Baccalaureate (IB) world school in China. With a progressive view towards education, innovation, inclusion and learning, I recognise my bias towards approaches to adaptation to GenAI that promote supported and safe uses of GenAI, rather than blanket bans or restrictions. In December 2022, I published the (If You) USEME-AI (2022a) model to support conversations and adaptations in international schools, based on earlier UNESCO guidance, the IB's Approaches to Teaching & Learning and Project Zero at HGSE's Creating Cultures of Thinking. I argued that a school's learning culture is a more powerful tool for adaptation than policy (Taylor, 2022b), though we have since published our "AI Philosophy & Guidelines" to summarise our school's position.

This paper builds on my previous (2023) paper on ethical approaches to GenAI, which explored the development of a range of ethical AIEd frameworks through the Bernsteinian lenses of the pedagogic device, focusing on control, power, classification and framing. Featured in the paper was an analysis of

publications by UNESCO until June 2023, and concluded with a recommendation for a single, comprehensive, adaptable and reliable framework for use in educational contexts. In the early development of this paper, I wrote a summary of The Guide in terms of its application for international education (Taylor, 2023b), which was adapted and published in the Winter 2023 edition of International School Magazine. This paper aims to avoid repetition of this work, and my previous paper, though where relevant to understanding some inclusions and adaptations have been made.

II. Methodology

In developing the critical analysis, close reading of The Guide, its release documentation and all relevant preliminary releases from UNESCO have been essential. Additionally, following and engaging with the lead authors on LinkedIN has helped clarify how The Guide is being translated, interpreted and operationalised in practice, including the collaborative development of their draft competencies framework. Building on my literature review of AIEd from the previous assignment, literature searches (including some preprints) related to GenAI continue to build understanding of GenAI in education as a rapidly-developing field of study.

Discussion of policy and the application of Bacchi's WPR framework stems from in-person seminars at the University of Bath's 2023 EdD summer school, which helped clarify my understanding of "policy as discourse" and the selection of WPR as an appropriate tool for analysis of The Guide. This was supplemented by further literature review using traditional library search and source selection. Source selection has prioritised texts of most relevance to understanding the implications of GenAI.

Research discovery was enhanced with the application of some GenAI tools relevant to academia, both as a support for research in this paper and as a practical demonstration of some current capabilities. This includes enhanced literature search through Semantic Scholar (www.semanticscholar.org/), Elicit (https://elicit.org/), SciSpace (typeset.io) and Perplexity (www.perplexity.ai), as well as some network-mapping with LitMaps (app.litmaps.co), to uncover related sources that might not have shown up under traditional search (see Appendix I). I gave a demonstration of some of these tools in a seminar at the summer school in July 2023 (Taylor, 2023c), and since spring 2023 I have been engaged with representatives from the University's Centre for Learning & Teaching (CLT) on discussion of institutional adaptation to GenAI.

Although some GenAI tools were used in research discovery, no AI-generated text has been used in the writing of this paper.

III. Theoretical Underpinnings: Policy as Discourse & Bacchi's WPR Framework

The Guide "*aims to support the planning of appropriate regulations, policies, and human capacity development programmes, to ensure that GenAI becomes a tool that genuinely benefits and empowers teachers, learners and researchers*". (UNESCO, Miao and Holmes, 2023, p.10). This approach of guidance on policy development, rather than the dictation of written policy, lends itself to poststructuralist discussion of "policy as discourse", in which policies (in this case The Guide) are not just "things" but are also "processes and outcomes" (Ball, 1993, pp.10–11). Ball (p.14), building on the work of Foucalt, notes that "*Discourses are about what can be said, and thought, but also about who can speak, when, where and with what authority. Discourses embody the meaning and use of propositions and words.*" He argues that the actors of policy make the meaning of policy, and through this discourse, the true effects of policy are realised (ibid). In analysis of The Guide, I lean on Carol Bacchi's suggestion that "policy-as-

discourse theorists define ‘discourse’ in ways that accomplish goals they/we deem worthwhile (...), to draw attention to meaning making.” (Bacchi, 2000, p.46), thus analysing UNESCO’s Guidelines through the lense of meaning-making in the international school context. How might The Guide shape practices in its application, and how might the ‘actors’ (schools, educators) shape and be shaped by the practical realisation of The Guide?

To attempt this, I will employ an interpretation of Bacchi’s “What’s the problem represented to be?” (WPR) framework as a model of poststructuralist discourse which creates “space in which to think” about problem representations (Bletsas, 2012, p.38). Rooted in poststructural feminism, the origins of WPR share space with some of the key ethical issues emerging from GenAI. Framed as a ‘tool’ or analytic strategy (Bacchi, 2009), the WPR approach can be applied “without immersing oneself in complicated theory” (Bacchi 2009, p.xxi, in (Goodwin, 2011), using analysis of texts that might “represent a ‘moment of crisis’ or are considered typical or representative of a particular practice” (Goodwin, 2011, p.172). I interpret the emergency of GenAI as ‘the moment of crisis’, where The Guide is a ‘representative practice’ that reflects the current leading set of recommendations for adaptation. Further adding to the dynamism of the problem, the change brought about by application of The Guide might in itself “trigger ongoing change” (Tsoukas and Chia, 2002, p.578); where “organization aims at stemming change, but in the process of doing so, it is generated by it.” (p.567).

With The Guide as a potential organising structure in a time of dynamic change, GenAI as an ‘unfixed problem’ (Chia, 1996), or a phenomenon that is not “singular, fixed or discrete” (Bacchi et al., 2016, p.14), WPR provides a clear framework for unpacking the complexity of this problem. It “starts from a simple idea: what we propose to do about something indicates what we think needs to change and hence what we think the problem is.” (Bacchi et al., 2016, p.16), promoting “a novel way of thinking that opens up many kinds of material to original and inventive interrogation”. (p.17). Through my approach to WPR in this paper, The Guide is selected as the “starting point” for analysis, with the problem representation acting as a “lever (that) necessarily involves familiarity with other texts that cover the same or related topics.” (p.17). In this case, The Guide is a “complex construction” (p.20) that sits as part of a documentation ecosystem from UNESCO, which will be outlined in the relevant WPR questions below.

The WPR approach structures discourse around a problem representation, which “does not involve a study of modes of language or rhetoric” (p.18), and where “discourses refer to knowledges rather than to language (p.21). This sits in contrast to Critical Discourse Analysis (CDA) (Fairclough, 2013), another interpretive approach to policy analysis (Bacchi, 2015) that focuses on the language used in policy text. WPR’s clarity, ease of use and potential for adaptation creates a focus that “means paying attention to the forms of knowledge that underpin public policies (...) producing a broad conception of governing that encompasses the place of experts and professionals” (Bletsas, 2012, p.22). Bacchi (2015) notes that problematization has no “single correct meaning”, affording flexibility in the application of the approach, allowing researchers to “give the term “problematization” a meaning that fits their analytic paradigm.” This is of relevance to The Guide as a text that has been developed by a large group of AIEd professionals, is intended to be translated and used to shape other policies across diverse settings and contains multiple problem representations; the recommendations of The Guide are of more importance than the language used in the text.

Analysis of the text is intended to make meaning of the problem representation through a series of seven steps, outlined in Fig. 2. These will be explained in each corresponding section. The questions serve an “heuristic function” (Bacchi et al., 2016, p.19), and it is possible “to draw selectively upon the forms of questioning and analysis (...), so long as a self-problematizing ethic is maintained.” (p.24) This analytic task “becomes teasing out the conceptual premises underpinning problem representations, tracing their genealogy, reflecting on the practices that sustain them and considering their effects.” (p.

17). My application of the framework will make some adjustments to the question sequence, to more logically reflect the development of the The Guide, using Step 7 to reflect on the application of The Guide to my precursor question.

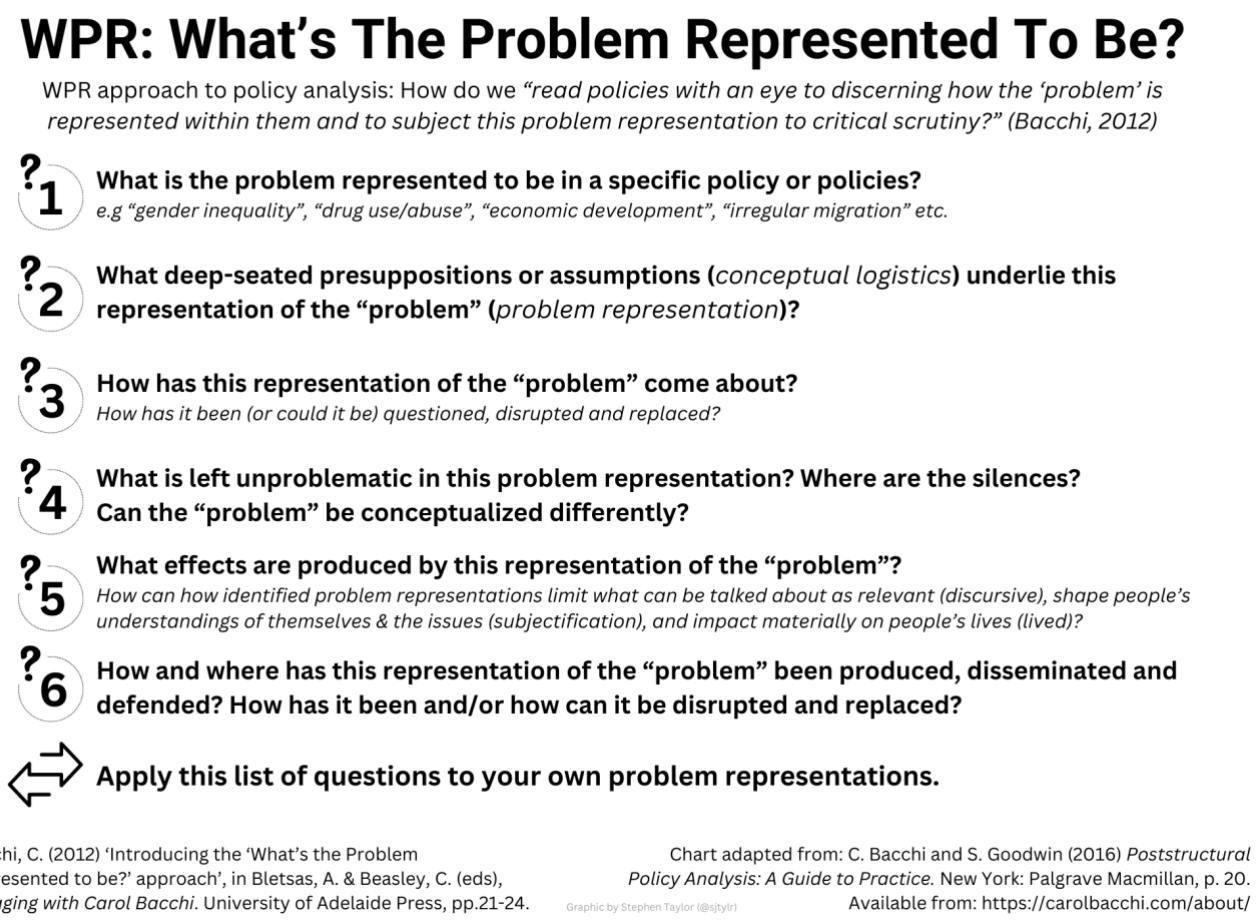

Fig 2: WPR Questions, adapted from Bacchi (2012, pp.21-24; 2017) and Bacchi & Goodwin (2016, p.20).

Previous Applications of WPR relevant to EdTech & International Education

Educational technology (EdTech) is not a new domain for research and has long been the subject of policy and adaptation. As such, Bacchi's WPR framework has been applied in diverse settings related to policy, including education, as its focus allows researchers to take part in a constructive act of meaning-making related to policies and developing situations. In fields surrounding EdTech, previous emphasis on technological tools and systems can be analysed with WPR to think through the social, cultural and pedagogical implications of the technologies, acting as a humanising framework for discourse and reflection.

Emma Törnblum's 2019 paper on *Digitalization and digital exclusion* in Swedish policy, explores the implications of "public sector agencies transforming into "digital agencies"", problematising the implications of a digital society for those who can easily adapt to digitalisation, versus those who are excluded. Its relevance to this work is that through the application of WPR, Törnblum frames the problem through Sweden's need to be internationally competitive, though the benefits of digitalization may not equally affect all citizens; parallels can be drawn here between adaptation to GenAI across education. Where Törnblum notes that "digitalization is represented as an external force that is transforming society," and that "digitalization policy is characterized by a pattern of neoliberal rationality,"

digitalization can effect “digital exclusion”. I suggest that similar vigilance should be taken in adaptation to GenAI, to ensure that digital divides and “digital poverty” in education are not worsened (UNESCO, Miao and Holmes, 2023, p.14).

Jiahui Luo (Jess)’s February 2024 paper *A critical review of GenAI policies in higher education assessment: a call to reconsider the “originality of students’ work* was the first publication to apply Bacchi’s WPR framework in relation to GenAI, and serves as a useful model for this paper. Focusing on the “AI-mediated landscape”, Luo analysed the GenAI policies of “20 world-leading universities”, focusing on “the primary problem (...) that students may not submit original work for assessment.” Although a much narrower focus than this paper, and taking a view of policy as text, in which she notes the disruptive force of GenAI presents challenges that “place significant pressure on universities to ‘bring order’ (...) through policymaking”, and “the lack of a robust policy framework on GenAI use in higher education adds to the difficulty for universities to quickly and effectively address GenAI-related challenges.”

Luo’s paper applies WPR with clarity, noting that “how problems are represented in policies matters because the representations carry implications for what is considered ‘problematic’ and in need of ‘fixing’”, concluding that “a critical silence in higher education policies in higher education policies concerns the evolving notion of originality in the digital age and a more inclusive approach to address the originality of students’ work is required.”

Although Luo’s paper makes mention of UNESCO and other higher-level guidance, she maintains a narrow focus on perceptions of originality in the context of higher education. The following application of WPR considers the full contents of The Guide with a focus on *Section 4: Towards a policy framework for the use of generative AI in education and research*, as a tool for discourse in shaping policy and guidelines in diverse educational settings, through the lense of K-12 international schools.

A final example of WPR in action relevant to this paper is Britney Hunter’s (2019) Critical Analysis of OECD’s Global Competence Framework, which applies WPR to identify blind spots in a competency framework that is referenced heavily in international schools. Schools aligned with UNESCO’s guidance might also be informed by OECD’s global competencies, and Hunter notes that “it demonstrates OECD’s power through policy changes in (...) education systems all over the world.” Similarly, UNESCO’s research and policy recommendations can have far-reaching influence, and through analysis of later impacts of UNESCO’s Guide on GenAI adaptation, it will be interesting to see the discursive, subjectification and lived effects through implementation.

Applying these examples of WPR into analysis of The Guide helps frame the problem in terms of relevance to technological implementation, higher-level policy guidance and the effects of both GenAI adaptation and policy implementation.

IV. Background: Introduction to UNESCO’s Guidance

September 2023 saw UNESCO’s Digital Learning Week (UNESCO, 2023f) , at which The Guide was released, with press-releases citing the urgency for “an urgent and coordinated response” (UNESCO, 2023c). The Guide was the first comprehensive framework for policy development and adaptation to GenAI released with global reach. Currently published in English & Spanish, The Guide is in the process of translation to multiple languages (Miao, 2024a,b). A supporting framework for AI competencies for education is currently under development (UNESCO, 2024), with open-invitation for collaboration and comment (Miao, 2024c).

The Guide is a concise and practical synthesis of the state of GenAI in Education & Research as of September 2022, which I propose serves as a useful tuning-in point for educational leaders in shaping their GenAI strategies (Taylor, 2023b). Following an introduction from Stefania Giannini, UNESCO's Assistant Director-General for Education, The Guide presents definitions and a series of chapters to set a foundation for understanding the opportunities and implications of GenAI, with recommendations for regulation and policy-making. Chapter 1 presents an accurate overview of how GenAI works, highlighting some of the implications for the emergence "EdGPT" works. Chapter 2 explores some of the controversies around GenAI, including worsening digital poverty, outpacing national regulation, use of data without consent, unexplainable models and outputs, AI-generated content polluting the internet, lack of understanding of the real world, reducing diversity of opinions and marginalised voices, and generating deeper deep-fakes. Chapter 3 moves into regulation, considering human-centred approaches (defined as "at the service of the development of human capabilities for inclusive, just and sustainable futures.). It continues with discussion of proposed regulations of GenAI in education (including data protection, strategic implementation, ethical regulation, copyright laws, frameworks for 'proper' use, and long-term implications), before outlining roles for governmental, inside and individual users.

Chapter 4: *Towards a policy framework for the use of GenAI in education & research* is the most relevant to this paper, and will be the foundation of my critical analysis, as "regulating GenAI to harness the potential benefit for education and research requires the development of appropriate policies" (p24). Building on UNESCO's AI and education: guidance for policy-makers (2022), this chapter presents eight key areas for policy development, with guidance for each:

1. Protect human agency.
2. Monitor & validate GenAI systems for education.
3. Develop GenAI competencies, including GenAI skills for learners.
4. Build capacity for teachers & researchers to make proper use of GenAI.
5. Promote plural opinions & expressions of ideas.
6. Test locally-relevant application models & build a cumulative evidence base.
7. Review long-term implications in an intersectoral & interdisciplinary manner.
8. Promote inclusion, equity, linguistic & cultural diversity.

The Guide concludes with Chapter 6 on *facilitating the creative use of GenAI in education and research*, with some strategies for institutions, pedagogy, curriculum and learning inclusion, and Chapter 7 forecasting some *potential futures of GenAI in education and research*.

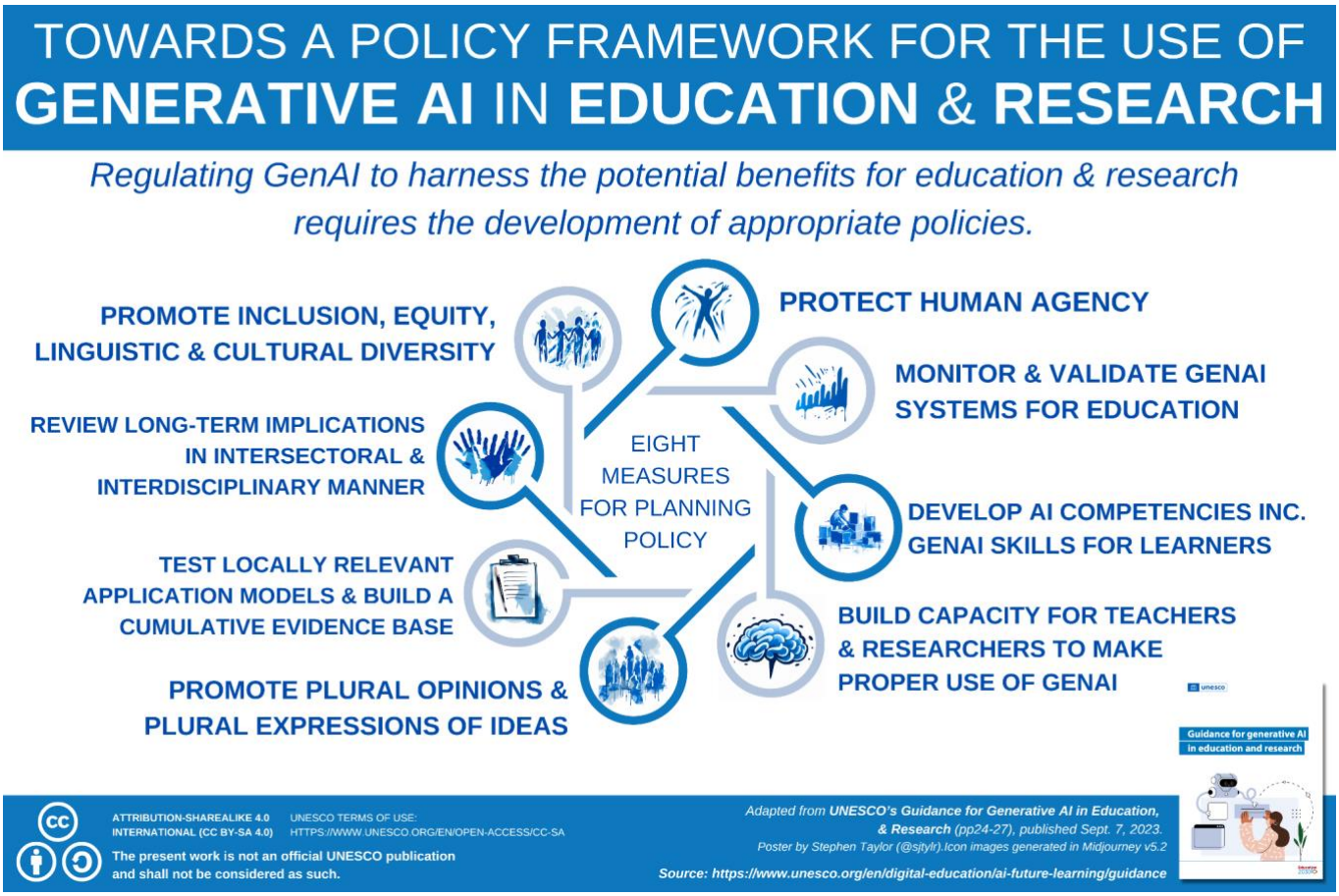

Fig 3: Graphical representation of section 4 of The Guide, adapted from (UNESCO, Miao and Holmes, 2023, pp.24–27), by Stephen Taylor. Image originally published at https://sjtylr.net/2023/10/01/unpacking-unescos-guide-for-genai-in-the-context-of-international-schools/

V. Applying WPR to UNESCO's Guide

Putting WPR to work on The Guide presents a challenge. Although just 44 pages, The Guide is a concise and dense synthesis of GenAI issues, considerations and policy recommendations, or a "complex construction that may well involve more than one problem representation.*" (Bacchi, 2017)* . In effect, each chapter and its contents could be subject to cascading WPR analyses, beyond the limits of this paper. Taking inspiration from Hunter (2019), I frame a "precursor question" to narrow the focus and open-up discourse, which will be later explored as an application of WPR to my own problem: "*Is UNESCO's Guidance for Generative AI (GenAI) in Education & Research "The Solution" to the problem of GenAI adaptation in international schools?*"

In approaching this problem, I will consider The Guide as a whole, paying closer attention to practical suggestions on Chapter 4. This will allow for consideration of The Guide as a single point of reference for international school policy-makers, whilst providing focused context for analysis. Although The Guide is intended to stand alone, I consider precursor publications and subsequent developments such as the ongoing development of a supporting competency framework (UNESCO, 2023g) to support my analysis.

A secondary challenge is that The Guide is not a policy for implementation in itself, but a recently-released set of guidelines for the development of policies for implementation in context, and there is limited evidence yet of the practical application of the guide. As such, some of the questions in WPR may not yet be answerable, however "in terms of practical application of WPR, it is possible to draw

selectively upon the forms of questioning and analysis, describe, so long as a self problematising ethic is maintained." (*Introducing WPR*, 2017, p.24). I will be selective in the application of the WPR questions, explaining rationale for adjustments , where necessary, in each section.

Q1: Problem Representation: What is "the problem" represented to be in UNESCO's Guide?

As Bacchi (2016, p.20) notes, "Problem representations provide the springboard, or lever, to the rest of the analysis," and that "policy texts are often complex constructions that may well involve more than one problem representation." The comprehensive nature of The Guide can be read to present multiple 'problems', though the 'major problem' is presented as a response to the "urgent need" to provide a "thematic set of guidance" in relation to "issues such as safety, data privacy, copyright and manipulation" and to "support the planning of appropriate regulations, policies, and human capacity development programmes, to ensure that GenAI becomes a tool that genuinely benefits and empowers teachers, learners and researchers." (p.7).

The authors therefore accurately problematise GenAI as an issue that requires a central set of guidance for shaping governmental and institutional response, and that this response requires understanding of a complex set of underlying problems, in alignment with UNESCO's educational values. These 'minor' problems include understanding the technological factors of GenAI, its controversies and implications, regulatory and policy approaches, possible applications and potential futures. Through this problematisation, The Guide has sought to fill a potential gap in UNESCO-aligned countries' adaptation strategies to GenAI in education.

Q2: Assumptions: What deep-seated presuppositions or assumptions (conceptual logics) underlie this representation of the 'problem' (problem representation)?

For this question, Bacchi notes that we are considering "how this particular problem representation was possible" by examining the "meanings that needed to be in place for it to make sense", that "we are seeking these meetings within the policy, program, or technical instrument, not in the heads of social actors," and that "in a Foucault- influenced post structural analysis discourse is referred to knowledges rather than language" (p.21). Through examining what has been made explicit (and what remains implicit) in the text, it is possible to identify a series of presuppositions and assumptions in the construction of The Guide.

With the term "human-centred" used 16 times throughout The Guide, a key assumption is that a "human-centred" approach that "promotes human agency, inclusion, equity, gender equality cultural and linguistic diversity, as well as plural opinions and expressions (and which ensures) ethical, safe, equitable and meaningful use) (p.7), is the most effective position from which to form policy around adaptation to GenAI. UNESCO asserts that through this approach "AI tools should be designed to extend or augment human intellectual abilities and social skills - and not undermine them, conflict with them or usurp them" (p.38), thus morally centring The Guide as a default and compelling resource for development of regulatory and policy frameworks. Nested within this assumption are the conceptual logics that human oversight is needed for this policy development and implementation, including through

regulation and monitoring, but that oversight should be informed by the position of UNESCO through The Guide and related publications.

The inclusion of key definitions (p.6) and sections on how GenAI works (pp.8-13) and related controversies (pp.14-17), suggests an assumption that not all in positions of responsibility related to policy development are cognizant of the technical, ethical and regulatory challenges presented by GenAI, and that The Guide should be a primary source in their upskilling. Related, UNESCO states that "despite calls for regulation from the AI industry itself, the drafting of legislation on the creation and use of all AI, including GenAI, often lags behind the pace of development" (p.14), building on the added assumptions that the GenAI will become more sophisticated and widely-used, that its development might be unpredictable, that multifaceted approaches will be required and therefore that a decentralised policy development approach, based on centralised policy guidelines (The Guide) is justified.

Further assumptions can be inferred from the inclusion and prioritisation of issues identified in the sections on regulating GenAI in education (pp.18-23) and policy frameworks (pp.24-27) which, although brief, contain 11 headings, 11 subheadings and 69 steps or bullet points, using assertive language ("developers should…") and active verbs ("commit", "support", "develop", "define", protect"...). Although few points are unpacked in depth, their inclusion aligns with the earlier positions of the document, and the reader can imply a hierarchy or sequence of sub-problems and their potential resolutions for local consideration.

Further implied is that UNESCO as "a global leader in education" positions The Guide as an authority on the specific problem of GenAI, referencing its alignment with the UN's Sustainable Development Goals (SDGs), UNESCO's Global Education 2030 Agenda, a "human-centred approach" and a large, diverse authorship. This claim to authority is somewhat justified; at the time of writing, no other organisation with the potential reach or educational influence of UNESCO has published such a comprehensive set of guidance, with the perhaps the closest equivalents of the OECD and UNICEF releasing their AI guidance in 2019 and 2021 respectively, before the release of ChatGPT, with the OECD's most recent reference to GenAI consists of collected research papers at the economic and societal levels (OECD, 2023).

Q3: Origins: *How has this representation of the 'problem' come about?*

Although Bacchi notes that the objective of this question "is to examine how a specific problem representation has come to be," and that one should "challenge any search for origins or any suggestion of some easily traceable evolution of a policy," I propose that understanding the process of development of The Guide can help "bring to light the plethora of possible alternative developments," in order to "disrupt any assumption that what is reflects what has to be" (p.22).

The Guide is firmly rooted in UNESCO's humanistic constitutional vision for education of "full and equal opportunities for education for all, in the unrestricted pursuit of objective truth, and in the free exchange of ideas and knowledge," (UNESCO, 1945), and its position as "the lead agent for SDG 4" (to ensure "inclusive and equitable quality education for all"), as part of the Education 2030 Agenda (UNESCO, 2023b). These mandates have clearly shaped the evolution of The Guide's outcomes and its development can be traced from before the release of ChatGPT through: 2019's *Beijing Consensus on AI and Education* (UNESCO, 2019); 2020's *International Forum on AI & The Futures of Education* ((UNESCO, 2020); 2021's *Reimagining our futures together: A new social contract for education* ((UNESCO, 2021) and *Recommendations on the Ethics of Artificial Intelligence* (UNESCO, 2022). Intermediary releases in response to ChatGPT signalled an acceleration of the field of AIEd, as well as in the development of UNESCO's guidance (UNESCO, 2023a, 2023d; *2023e; 2023f*), before the final

release of The Guide as part of 2023's Digital Learning Week (UNESCO, 2023g). Visualised in Fig. 4, Digital Learning Week and a focus on GenAI was part of a wider network of development at UNESCO related to AI and digital futures of education and work, and since the release of The Guide, accompanying competency frameworks are under development (Miao, 2023c, UNESCO, 2023h), along with calls for examples of 'best practices' related to GenAI in education (Miao, 2024b).

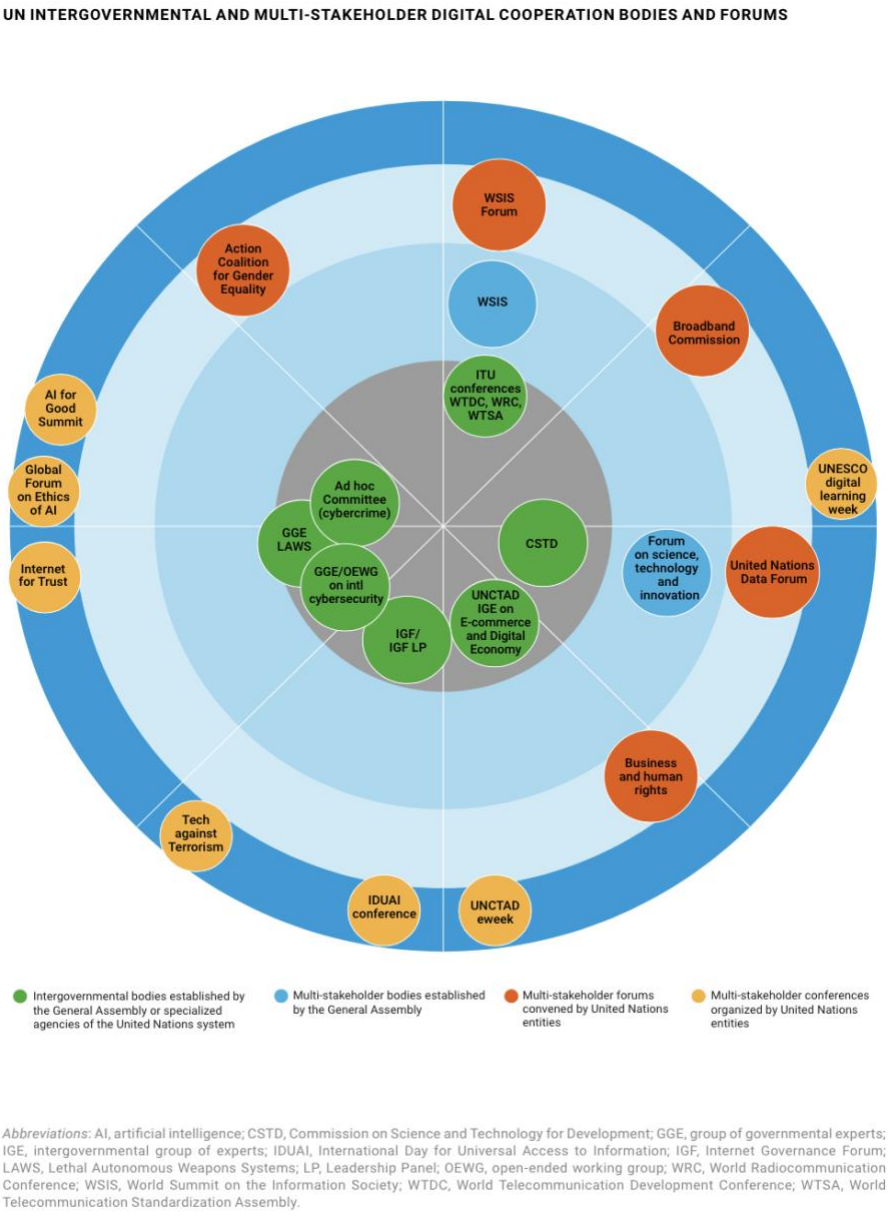

Fig 4: Digital Learning Week in the context of UNESCO's AI development, from the UN's "Our Common Agenda Policy Brief 5: A Global Digital Compact — an Open, Free and Secure Digital Future for All (UN-EOSG, 2023, p.26).

Although iterative, well-funded and international in scope and authorship (with 23 credited authors, organisations and contributors), there are alternative developments that could have been possible. Through taking a "human-centred" approach, The Guide prioritises positions in alignment with the values of UNESCO, and although there is some inclusion of technical background and reference to issues of the policy-lag between governments and GenAI development, its authorship is skewed towards expertise in education and research, without notable contribution from developers of leading GenAI platforms with the technology industry. As a result, many of The Guide's proposals imply potential conflicts of interest between regulatory bodies and technology companies, with a focus on data privacy

and protection. Section 3.3.2 on regulations for “providers of GenAI tools” (pp.21-23), states that “it should be made clear to GenAI providers that they are accountable for ethics by design”, with ten recommendations that might take a different form if developed in collaboration with those companies to be regulated.

Further alternative representations of the problem might be more a function of timing than opportunity; as the first comprehensive document of its kind in a rapidly developing field, The Guide notes that “by early 2023, some 67 countries had developed or planned national strategies on AI,” and that none of them “had yet covered generative AI” (p.19). This results in a set of guidance that, although comprehensive and well-reasoned, is not yet representative of regional variations or necessarily founded in concrete examples from diverse regulatory environments. Similarly, despite the relatively large authorship, The Guide cannot benefit from the diverse perspectives or experiences from educators and researchers from around the world, although it does note a balance in immediate responses between “shock waves”, bans and academic misconduct with potential applications and innovations.

Finally, there is no update mechanism identified. Where the The Guide concludes that “the transformation of education and research to be triggered by GenAI, if any, should be rigorously reviewed and steered by a human-centred approach,” (p.38), a similar approach could be employed by UNESCO on their own guidance, potentially addressing some or all of the issues above, through the development of more region-specific versions, including more diverse voices from the education, research, technology companies, students and other actors, based on the embedded experience of GenAI in their own contexts.

Q4: Silences: What is left unproblematic in this problem representation? Where are the silences? Can the ‘problem’ be conceptualised differently?

For questions 4 and 5, I will focus in more detail on Sections 3 and 4 of The Guide, as they provide a comprehensive overview of recommendations, through which silences and effects can be identified. The goals of question 4 is “to destabilise an existing problem representation by drawing attention to silences or unproblematized elements within it“ (Bacchi & Goodwin 2016, p.22). Through closer analysis of section 3 (regulatory recommendations) and section 4 (policy recommendations), I look for silences and alternative conceptualisations of ‘minor problems’ with The Guide in relation to their potential impacts. It should be noted here that The Guide presents a comprehensive list of summary recommendations in sections 3 & 4; thus, the term ‘silence’ should be interpreted as ‘quietness’ on areas that are identified but that have space for further discussion. As noted in Q3, the dynamism of the field has also resulted in some ‘silences’ that at the time of its drafting were may not have been conceptualised (or which have moved at a faster pace than predicted).

The Guide refers to “digital poverty” and the potential for GenAI to exacerbate digital inequalities (p.14), with the policy recommendation to “take action to promote universal connectivity and digital competencies in order to reduce the barriers to equitable and inclusive access” (p.24), though doesn’t elaborate on how this can be effectively achieved at scale. This ‘quietness’ also does not account for the emergent silence of the growing divide between (currently) free GPT-3.5 class and paid GPT4+ class “frontier models” (Mollick, E. 2024, p.23), which typically cost around US$20 per month for subscriptions (Rogers, 2024), with access potentially limited by region and credit card status. Although some open-source models are freely available, such as those hosted on Hugging Face (https://huggingface.co/), the contrast in performance between models is large, which risks the potential benefits of GenAI skewing towards those who can already afford the subscriptions costs, along with the time and training required

to make them work effectively. An alternative conceptualisation of this sub-problem might be to move beyond “promoting” the use of GenAI and developing GenAI competencies and skills for learners (p.24) towards ensuring truly equitable access through subsidy or building on the later recommendation of “locally relevant application models” (p.27), perhaps taking inspiration from approaches such as *AIED Unplugged* (Isotani et al., 2023) and similar movements to remove some of the barriers to accessibility of GenAI tools.

Intertwined with the digital divide is the relationship between The Guide’s recommendations on “protecting human agency” in education (pp.24-25), and the implications of GenAI on employment and human capital. With The Guide building on UNESCO’s *Reimagining our futures together: A new social contract for education* (2021), there is a focus on education and education providers, though there is limited consideration of the implications of GenAI on the future work prospects for those currently in education. Alternative conceptualisation of this problem to expand on The Guide’s recommendation for “GenAI competencies” (pp.25-26) to include careers intelligence (Taylor, 2023d), investment in public resources for upskilling, reskilling, innovation and economic research (Kitsara, 2022; Rana, 2023); shifting the focus from ‘adapting to GenAI in education’ to ‘adapting education and work for GenAI’.

Currently only published in English, Spanish and Arabic, The Guide’s relatively general guidance recommends promoting “inclusion, equity, linguistic and cultural diversity,” with specifications that should “require providers of GenAI to include data in multiple languages, especially local or indigenous languages” (p.27) in their training, to prevent the “intentional or unintentional removal minority languages or discrimination against speakers of indigenous languages” (ibid). As more models become multilingually-competent (Ahuja et al., 2023), recent developments have potential to employ AI (in alignment with careful language policy development for the revitalisation, documentation and preservation of indigenous and endangered languages (Iyinolakan and Ogbu, 2022; Pinhanez et al., 2023). In contrast, the current most popular models can translate many languages, yet still struggle with complex, idiomatic or contextual translation (Cai and Duan, 2023)). There is potential to reconceptualise this problem through further exploring The Guide’s recommendations towards promoting “plural opinions and plural expressions of ideas” (pp.26-27), by not merely recommending vigilance for inclusivity, but to advocate for research and development into the applications of GenAI towards active preservation of linguistic and cultural diversity.

Aligning cultural and contextual relevance with The Guide’s mandate of ethical and moral considerations, there is minimal reference to the norms of diverse societies affected by this global problem, leaving space for discourse related to the implications of enacting the recommendations in situ. Building on the recommendations to “test locally relevant application models and build a cumulative evidence base,” and to “review long-term implication in (an) intersectoral and interdisciplinary manner” (p27), there is scope to consider ethical GenAI policy recommendations that consider the academic and social structures in diverse situations.

The intersectional and interdisciplinary review of long-term implications (p.28) can be implied to suggest a need for sustained research and development into GenAI in education and research, though this is not clearly stated or elaborated. With the frequency of new tools, applications and implications in education, an alternative conceptualisation of this sub-problem could be to further promote the investment in and support for research.

A further ‘quiet silence’ of The Guide regards the early controversy of “AI-generated content polluting the internet” (p.16), which is only briefly mentioned in the document. Since The Guide’s publication, AI-generated content flooding the internet (colloquially known as “enshittification” (Doctorow 2022, 2023) or “junkification” (Lubin 2024)), and reducing the value of the commons appears to be having a faster impact than predicted (Vincent, 2023), with examples include AI-generated books on Amazon, content

on websites, fake images, news and media and the SEO-optimised content that gets pushed to the top of searches. This may create significant implications here for learners and learning, as well as for accuracy and quality of information, as edtech pedagogies and research processes need to account for reduced trust in content consumed online. Although regulation has yet failed to stem the tide of fake and abusive AI-generated content on the internet (Amnesty International, 2024), I propose that further iterations of The Guide or parallel projects conceptualise this as a problem in its own right; with a focus on protection of the internet as a foundational resource for education and research.

Q5: **Effects:** What effects (discursive, subjectification, lived) are produced by this representation of the 'problem'?

The volatility of the problem and the recency of The Guide provide some challenge for addressing this question, though it is possible to infer some potential effects of the problem representation. Bacchi notes that question 5 "makes it possible to reflect on the complex array of implications that problem limitations entail in certain contexts and to promote interventions that aim to reduce deleterious consequences for specific groups of people," by examining the effects of the problem representation through three lenses: discursive effects, subjectification effects and lived effects. *Discursive effects* show "how the terms of reference established by (the) problem representation set limits on what can be thought and set." *Subjectification effects* "draw attention to how 'subjects' are implicated in problem representations." *Lived effects* consider how "discursive and subjectification effects translate into people's lives." As with question 4, my analysis focuses on sections 3 & 4 of the guide as those potentially 'closer' to the subjects of the policy and regulation recommendations.

In terms of discursive effects, The Guide provides a structure for discourse on the potentially global norms, standards and responses for the ethical and inclusive use of GenAI in education, and if adapted to suit local contexts could influence the work of policymakers, institutions and educators. As noted in the Q1-3, the emphases of the The Guide towards human-centred approaches and the sequential identification of implications, applications and recommendations may potentially guide actors' discourse towards similar outcomes in the shaping of their own educational agendas. By framing GenAI in education as a "public problem" (Ananny, 2024), this may influence discourse at the public level, potentially shaping societal views on the myriad roles GenAI might play in the lives, education and work of the public.

The Guide identifies a range of 'subjects', which may be used by policy actors to assign roles and responsibilities in response to GenAI. Implicit in the publication of The Guide is the need for governments and international agencies (such as UNESCO) to provide regulatory and policy structures under which other actors fall, with further roles (institutions, administrators, educators, students) defined across the educational ecosystem. This in turn might influence the identity and agency of those actors, dependent on their lived experiences in terms of inclusion and representation in policy development and the enactment thereof.

Finally, although the 'lived effects' of the problem are yet to be fully realised, some may be predicted. Within the introduction of The Guide, "the initial concern (that) ChatGPT, and similar GenAI tools would be used by students to cheat on their assignments" (p.7), is raised, signaling the potential for its recommendations to influence pedagogical and assessment practices within schools. Similarly with a full section dedicated to "facilitating creative use of GenAI in education and research" (pp.28-35), and the ongoing development of educator and student competencies for the use of GenAI (UNESCO, 2024;

Miao, 2024c, Appendix II), potential implications of the enactment of its recommendations could lead to further enhancement and promotion of educational technologies in classrooms. This resurfaces the potential lived effects of the digital divide and (lack of) equity of access to GenAI's capabilities; a matter to be addressed in parallel with the responses in policy, pedagogy and implementation.

Q6: Problematic Representations: How and where has this representation of the 'problem' been produced, disseminated and defended? How has it been and/or how can it be disrupted and replaced?

Similar to question 3, question 6 considers how the problem has been shared, but more critically emphasizes "the existence and possibility of contestation": alternative perspectives "that challenge (or could challenge" pervasive and authoritative problem representations" (p.24). As a relatively recent publication, there is yet to be significant academic critique or defense of its proposals, though The Guide has been disseminated widely, through UNESCO's own publications, Digital Learning Week and social media, leveraging UNESCO's global reach and credibility, with frequent resharing and summarisation by educational institutions and individuals. This active promotion and advocacy for The Guide's recommendations can be seen as defense of said proposals, along with the nascent integration of the policy recommendations into policies of educational institutions (*Generative Artificial Intelligence Policy*, n.d.; Western Academy of Beijing, 2022; Minnesota State University, 2024), with further endorsement through UNESCO's partnership with the European Union likely to further influence policy development in the EU's member states (UNESCO, 2023e).

In terms of contestation or potential replacement of The Guide's recommendations, potential space for discourse may be opened up around UNESCO's relatively conservative stance on GenAI, implied through the focus on regulatory oversight in the document. Other potential avenues for contestation might open up when The Guide is applied in contexts not thoroughly considered in its drafting, or through potential push-back from technology companies or those seeking to accelerate, rather than regulate, the pace of development and implementation of GenAI in education and research.

VI. Discussion: Is UNESCO's Guidance for Generative AI (GenAI) in Education & Research "The Solution" to the problem of GenAI adaptation in international schools?

Critical analysis of The Guide through the problem representation outlined above allows me now to focus on Bacchi's seventh step, applying the WPR analysis to my own preliminary question, situated in the application of UNESCO's recommendation in the international school setting. This is approached through discussion of the strengths and limitation of The Guide for this context, followed by discussion of implications, applications and recommendation for its use in international schools. In the WPR context, UNESCO's guide creates space for discourse around this "unfixed problem", providing a problematisation and set of questions to leave open-ended the solutions to the problem of GenAI in different educational and national contexts.

Strengths and Limitations of UNESCO's GenAI Guidance

UNESCO's guidance presents many strengths to support its utility for international schools. As a comprehensive and freely-accessible document, it provides a 'one stop' starting point for school leaders and policymakers. Its global recognition and the credibility of UNESCO (and its authorship) lend an authority to the document that could form a reliable basis for local policy drafting. As a series of recommendations *for* policy, rather than dictats *of* policy, The Guide creates space for effective localisation, though this would need local expertise in both GenAI and the educational context. Although concise, the document provides many subheadings and points for discourse in the context of the institution; as a complex, 'unfixed' problem, GenAI is not known to be widely well understood, so The Guide's structure and content present a useful primer for non-experts to make informed decisions. Although translated into some languages (with others incoming), The Guide's writing style of short sections and bullet points can be relatively easily translated using automated software, and ongoing development towards supporting competencies might make The Guide's recommendations more actionable in school settings.

The Guide's philosophical, "human-centred" stance presents another area of strength in terms of application to the international schools setting, in particular to those schools that are mission-driven and guided by values-based principles similar to those of the IB. With a mission to develop "inquiring, knowledgeable and caring young people who help to create a better and more peaceful world through education that builds intercultural understanding and respect" (IBO, n.d.), and as the first international education agency to make a statement in support of the use of GenAI (Glanville, 2023), the IB's stance aligns strongly with many of the recommendations of The Guide. Similarly, the IB's approaches to teaching, learning and learner agency can be paralleled with The Guide's focus on protecting human agency, and ensuring that GenAI does not replace the work of teachers or the work of learning. Further, the focus on inclusion, equity, linguistic and cultural diversity in The Guide are reflections of the values of large parts of the international education sector, thus providing schools the opportunity to align their adaptation to GenAI with their institutional goals.

Despite the strengths, there are some limitations that international schools would need to consider in applying the recommendations to their contexts. Although comprehensive, the recommendations of The Guide would require expertise and understanding of the local, regulatory and educational contexts of the school to be converted into working policy requiring significant expertise and investment. This may be beyond the capacity of individual international schools and might benefit from more detailed support from collaborative partners and/or accrediting agencies.

As identified in the WPR analysis above, there are some 'quiet silences' that would require further research and support, including the implications of GenAI for effective inclusion in multilingual and multicultural communities, aligned with the host country. Consideration of the "junkification" of internet resources relied upon for learning should be considered carefully as part of a school's adaptation, regardless of their stance on GenAI in the classroom, and schools will need to consider the rapid pace of GenAI development since publication of The Guide to verify and update some of the recommendations. Similarly, some of the assumptions identified are worth critical discourse before developing local policy, including the alignment of UNESCO's values with their own, including some terms (e.g. "agency"), align with their contextualised definitions.

Implications, Applications & Recommendations for UNESCO's GenAI Guidance in international education

Overall, The Guide does provide a substantial basis for policy development and future planning for international schools, based on reliable foundations in international schools that are mission-aligned with the “human-centred” values of UNESCO, with some implications and applications to consider. Significant adaptation required for local regulatory contexts, school budgets, pedagogical values and capacity for change will need to be carefully considered, which might benefit from local and international cooperation, and support from accrediting agencies. The centring of GenAI adaptation on ethical and inclusive practices might help schools focus on values and deeper-rooted systems, rather than ‘panic responses’ to the perceived threats of GenAI. This will require investment in professional training and development, and integration of recommendations into curriculum and pedagogical approaches, which can be centred on the recommendations and chapters from the Guide and associated projects. The Guide’s recommendations can also be used to vet potential AI tool adoption based on ethical principles or Guide recommendations, though monitoring and evaluation of school’s responses and implementations based on the recommendations should be integrated with the development of policy.

Exploration of potential applications of The Guide in international school contexts surfaces further recommendations to support GenAI adaptation, including local translation, customisation and updating of recommendations. International schools tend to have complex ecosystems of policies related to learning and inclusion, which will need to be considered in development of localised GenAI policies, to ensure cohesion and clarity of communication. Schools should consider collaboration and sharing of policy, guidelines and best practices with other ‘like’ international schools and consider participation and piloting of UNESCO’s teacher and student competencies, to facilitate continual review, feedback and monitoring for fidelity, safety, ethics, inclusion and current understanding of GenAI’s opportunities and challenges.

VIII. Conclusions, Limitations & Future Studies

Despite Bacchi & Goodwin’s (2016, p24) note that poststructual analysis can be questioned and “something like WPR leaves us mired in field of competing interpretations with no precise recommendations of “ways forward”,” I have found value in applying WPR; a clarifying experience, challenging the assumed authority of UNESCO’s Guide to consider the problem representation in our context. WPR has acted as a tool for analysis of the “unfixed problem” of GenAI policy recommendations for international schools, concluding that UNESCO’s Guide presents multiple “levers” for opening space for discourse. Taking a “policy as discourse” approach (where ‘policy’ represents UNESCO’s recommendations), allowed for critical analysis of The Guide, uncovering problematic representations, assumptions, silences and potential effects, which can be useful in an international school’s consideration of applying the recommendations to their own context. Applying WPR leads me to the conclusions that although The Guide may not be “the solution” to the problem of GenAI adaptation in international schools, it is currently the “best” solution as a starting point for contextualised investigation and adaptation, providing an understandable and operable framework for local policy development.

There are some limitations of applying WPR as I have in this paper. The broad scope of The Guide leads to many “nested” problem representations, including individual policy recommendations and some of the ‘quiet silences’ noted above. Future applications of WPR with this text could focus on closer analysis of some of these “nested” problem representations. The recency of UNESCO’s publication and the dynamism of problem also present challenges to applying WPR with fidelity, most notably in areas of

(quiet) silences, and a current lack of research on the discursive, subjectification and lived effects of the recommendations of The Guide when put into practice through local policy implementation. Over the coming years, I predict this might be an interesting research opportunity for policy authors and actors to apply WPR to their own contexts, evaluating their implementations of UNESCO's recommendations.

Further areas for research might include analysis of collected policies relating to more focused areas of the recommendations, using an application of WPR similar to Luo (2024). These might include samples of policies related to data privacy, ethics, inclusion and monitoring of GenAI models and implementation. As UNESCO's accompanying competencies for teachers and students are pilot-tested, there may also be opportunities for comparative analysis of the effects of these recommendations in different contexts.

As GenAI continues to have significant impacts on education, including international education, the need for clarity and guidance in a dynamic environment will continue to grow. Resources such as UNESCO's Guide can provide a starting point for educators and policymakers, though discourse using tools such as WPR may help contextualise recommendations when making local adaptations.

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Appendices

Appendix I: GenAI tools used in this research paper

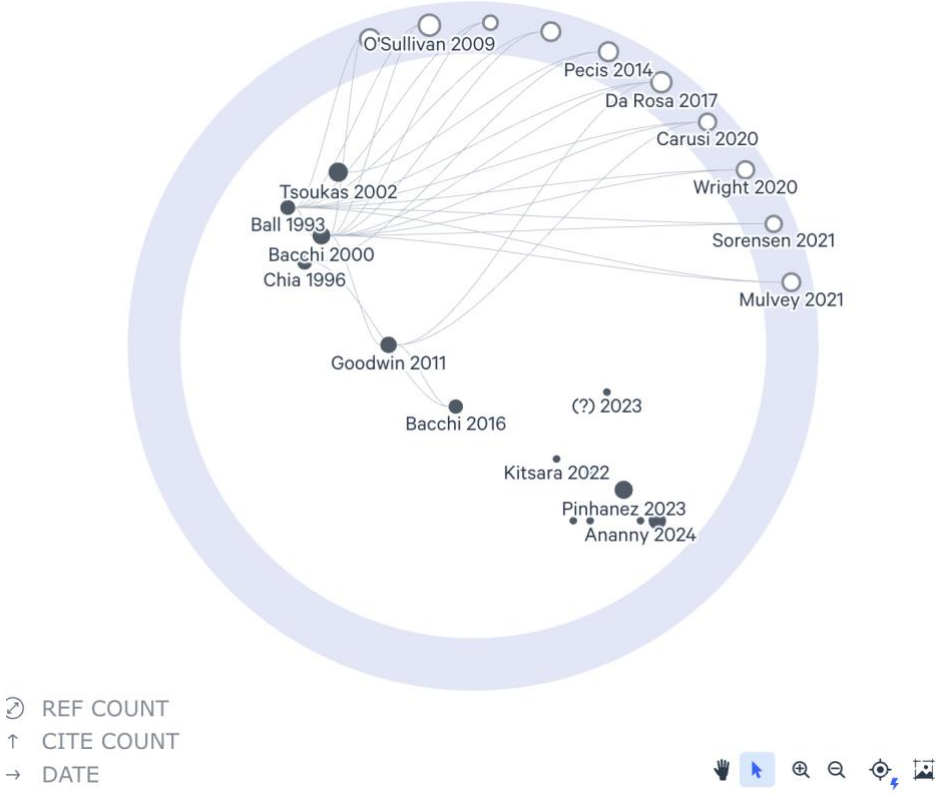
Although some GenAI tools were used in research discovery, no AI-generated text has been used in the writing of this paper. This Appendix outlines the application of GenAI tools used in research discovery.

Semantic Scholar (https://www.semanticscholar.org/)
Similar to Google Scholar, Semantic Scholar is an AI-enhanced literature search tool, allowing for research discovery and curation, and finding connected papers.

Elicit (https://elicit.com/) & SciSpace (https://typeset.io/)
Two very similar applications, Elicit & SciSpace allow for deeper search, note-taking and research discovery through question-based queries. Both provide summaries of abstracts, allowing for source selection for follow-up, and link out to original paper sources. SciSpace has multilingual options for accessing papers written in other languages.

Perplexity (https://www.perplexity.ai/)
Perplexity was one of the first AI tools to use a live internet connection in GPT-based search, and has an 'Academic Mode' that focuses search on Semantic Scholar. Queries in Perplexity are returned with references and allows for follow-up questions. This can aid in source selection.

Litmaps (https://app.litmaps.co/)
Litmaps can create network maps of references, helping identify gaps in literature review that might not be discovered through traditional search. The image below shows a LitMap of a few sources used in an early draft of the paper (centre) surrounded by suggestions for related papers to consider (blue ring).



Appendix II: GenAI Competencies for teachers & Students

LinkedIn posts from Fengchun Miao, lead author of UNESCO's Guidance, connected to the development of UNESCO's ongoing "Digital competencies for teachers and school students in Member States of the Group of 77 and China" project" (site published 22 April, 2024): https://www.unesco.org/en/digital-education/g77-competencies

"AI competency framework for teachers: implementation strategies
https://www.linkedin.com/posts/fengchun-miao-5b999077_ai-competency-framework-for-teachers-implementation-activity-7162877520193769472-Mjx1?utm_source=share&utm_medium=member_desktop

As we are finalizing the AI competency framework for teachers, I am proposing the following updated implementation strategies. Please let me if we are missing some critical perspectives.

1. Regulate AI and ensure trustable AI tools for education
[Ensure ethical AI tools introduced to schools before asking teachers to make ethical use of AI]

2. Build conducive policy frameworks for the use of AI in education
[Create conducive policies including incentives and conducive curriculum and assessment before forcing teachers to learn endlessly updated AI tools and use AI tools that even policy-makers don't know what they mean]

3. Protect teachers' right and define local AI competencies frameworks for teachers
[Protect teachers right before introducing machine into classrooms, protect their right to job before asking them to develop new competencies; locally relevant priorities of AI competency frameworks]

4. Streamline teacher training and support programmes on AI competencies
[Pre-service, in-service, school-based support]

5. Develop evaluation criteria to facilitate assessment of levels of AI competence
[Monitoring and assessment tools; self-assessment criteria for teachers]"

AI competency framework for teachers (under development)

Aspects	Progression		
	Acquisition	Deepening	Creation
Human-centred Mindset	Benefit-risk analysis	Human accountability	AI society responsibility/Social human agency
Ethics of AI	Ethical principles	Safe and responsible uses	Co-creating commons of AI ethics
AI Foundations & Applications	Basic AI technique and applications	Application skills	Creating with AI
AI Pedagogy	AI-assisted teaching	AI-pedagogy integration	AI-enhanced pedagogical transformation
AI for Professional Development	AI as enabler of lifelong professional learning	AI to enhance organizational learning	AI to support professional transformation

AI competency framework for students (under development)

Aspects	Progression		
	Understand	Apply	Create
Human-centred mindset	Critical views of AI	Safe use	Self-fulfillment in AI era
Ethics of AI	Understanding human agency	Responsible use	AI society skills
Foundational AI knowledge	Algorithm literacy Data literacy	Coding and data processing	Algorithmic data analytics
Application skills	Domains and technique of AI	Practical skills	Modifying or creating tools
*Design thinking for problem solving	Problems abstraction	Model architecture	Co-creation