Available online at ijci.wcci-international.org

International Journal of Curriculum and Instruction 18(3) (2026) 397–418

IJCI
International Journal of Curriculum and Instruction

The Use of Policy Analysis Frameworks in Mathematics Education Research: A Systematic Review of Ghanaian and Open-Access International Policies

Raphael Owusu [a] *, Ebenezer Bonyah [a], Saidat Adeniji [c]

[a] *aUniversity of Skills Training and Entrepreneurial Development, Kumasi, Ghana*
[b] *University of Southern Queensland, Toowoomba, Australia*

Abstract

Policy analysis in mathematics education helps to comprehend curriculum reform, assessment instruments, teachers' development, and equity within classrooms. However, the application of policy analysis frameworks within mathematics education studies is a not-well-explored area, especially in African settings. This study systematically synthesise available literature on the application of policy analysis frameworks within mathematics education studies, focusing on Ghanaian policies and open-access international publications. Adopting the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, a search across Google Scholar, ERIC, and EBSCOhost generated 648 publications of which 18 met inclusion criteria. The review established seven studies employing the case study framework, six utilising systemic pattern analysis, and three and two applying chronological mapping and international horizon scanning, respectively. The results show the sparing yet increasing application of the above frameworks within mathematics education studies, emphasizing the need for improved application of policy frameworks in Ghana and its equivalents to consolidate evidence-informed decision-making and propel equity within mathematics education.

Keywords: Policy analysis; policy frameworks; mathematics education research; systematics review

1. Background

Mathematics education is an area that holds significance and strategic importance for national development, as it underpins scientific advancement, technological development, and economic competitiveness. In Ghana, as with many other settings, mathematics

* Corresponding author: Raphael Owusu ORCID ID.: https://orcid.org/0000-0003-4072-0013
E-mail address: waldoralph02@gmail.com

functions as an indispensable and foundational curricular element in schools, critically reflecting national policy objectives that encompass the broader aspirations for social equity, labour force preparedness and national development (Hoyles et al., 2013). The relationship between mathematics education and policy is an area of interest, negotiation, and contestation where the intersection of research, practice, and political priorities constitutes a dynamic and often contentious space, frequently characterized by inherent tensions and conflicting imperatives (Pais & Valero, 2012; Myers, Kokka & Gutiérrez, 2023; Boylan, Adams & Birkhead, 2023). This systematic review focuses on Ghana-based frameworks of policy analysis within mathematics education research and open-access international policy reform documents. The desire for this focus relates to the increasing realization that policy influences practice and practice and research can influence policy (Boylan et al., 2023).

Policy analysis frameworks serve as an invaluable tool for educators to critically appraise, understand, and compare the formation, enactment, and outcome of educational policies (Lempert et al., 2003). The role of policy analysis in mathematics education is pivotal in providing an in-depth understanding of curricular changes, assessment tools, teachers' professional development, and how equity is developed and achieved in the classrooms and schools. Nevertheless, as detailed by Boylan et al. (2023), the use of policy analysis frameworks in mathematics education research is a relatively new and emerging area requiring exploration, particularly in low and middle-income countries such as in Ghana. The conspicuous absence of discourse regarding mathematics education and its associated policy interventions is particularly striking. This oversight is perplexing, given the widely acknowledged politically charged, socially relevant, and synergistic nature of these efforts at both national and international scales.

The focus on Ghana is informed by its established and existing standard-bearer in education demonstrated through the implementation of reforms, and mathematics education role in maintaining continuous development in both policy and practical endeavors (Adu-Gyamfi, Donkoh & Addo, 2016; Mereku, 2023; Agbozo, Bonyah & Clark, 2024; Lotey et al., 2023). For example, the Basic Education Curriculum has made a proponent that numerical literacy is crucial for all levels of learners, aligning the curriculum with the global trends and showcasing mathematics as a gateway to other learning aspects and an understanding which supports the participation in the economic issues (Ministry of Education, Ghana, 2019). Notwithstanding this, the existing challenges in the quality, equality, and outcomes of the education system speak volumes in need of comprehensive and systematic policy analysis to determine the ongoing reforms. Besides this, the fact that Ghana is among the 11% of African countries involved in TIMSS and PISA is a proof that mathematics education policies have been under the spotlight of the global policy world for a while. This international policy context, fueled by the ascendancy of standards, rising demands for accountability, and a quest for evidence-

based reform, the nexus of international and domestic mathematics education policy aligns (Boylan et al., 2023).

The policy of mathematics education is shaped by the involvement of several actors, institutions, and global trends (Ball, 2012; Lingard & Sellar, 2016; Kadijevich, et al., 2023). The Organisation for Economic Co-operation and Development (OECD), which conducts PISA, for example, is one of the agencies that has greatimpact on the policy agenda of the nations and is often involved in the process of promoting certain curricula, assessment, and pedagogical models (Kadijevich et al., 2023). Just as with a comparable case from England, the National Institute of Education (NIE) from Singapore acts as a coordinating center of practice, of policy, and of research, placing it well to attain a more cohesive strategy for addressing application and development of policy (Kaur et al., 2023). These international examples help to recognize the policy in mathematics education of different countries and point out the frameworks that reflect context-sensitive as well as global perspectives in the field of mathematics education.

While it is true that policy is critical in mathematics education, there are few studies on the subject of policy itself (Hodgen et al., 2022). Current literatures tend to present education policy as largely a context-defined rather than a universal framework to be analyzed holistically but one to be interpreted and applied locally (Ozga

, 2000; Lingard & Sellar, 2016). This gap in research is a serious drawback as it confines the field's capability to question the assumptions, opinions, and power struggles that are part and parcel of policy texts and procedures. Nguyen (2024) noted that policy enactment in the field of mathematics education significantly revolves around the discourses on mathematics' nature, actual high-quality teaching, learning, and questions of equity and excellence. These discourses, however, are taken for granted most of the time. However, they have far-reaching effects on how the policies are drafted, read, interpreted and achievedacross the different levels of the education system. By highlighting these discourses, templates for the analysis of policy can help scholars and practitioners question dominant accounts and explore different positions for mathematics education development.

Consequently, a systematic review that synthesises evidence on this topic is required. The review is set to collect, analyze, and critique the application of policy analysis frameworks in mathematics education research, featuring Ghanaian and open-access international policies. This focus offers more theoretical and critical research on mathematics education and policy, furthering the descriptive level into the conceptual and methodological frontline of policy analysis (Hoyles & Ferrini-Mundy, 2013; Han et al., 2023). Furthermore, it satisfies the need for research, which is based on the context and considers the educational systems of different countries as unique, while it also binds these systems to the powerful forces operating globally (Boylan et al., 2023). The focus on

open-access international policies will ultimately promote access to the policy knowledge and create comparative insights that will be used by both research and practice.

1.1. Policy Analysis Frameworks

Various policy analysis frameworks like the Multiple Streams Framework, Advocacy Coalition Framework, and policy cycle models are frequently employed in broader education policy studies to trace the direction of policies, recognize the main participants and factors, and to research evidence, factors, and interests interplay in the policy formulation process (Boylan et al., 2023). The simplest and most effective framework, with the help of which policy change is explained due to the confluence of three streams (problems, policy, politics) at the critical moment leading to the opening of the "policy window," is Multiple Streams Analysis, proposed and developed by Kingdon 1984. The author previously stated the belief that in mathematics education, the framework can be especially useful in studying the conditions that contribute to the emergence of a particular problem becoming the focus of policy intervention (Cairney, 2012; Adams & Boylan, 2023).

The role of advocate groups in the policy process, acting as the co-creators of policy through collaboration over time, is the main focus of the Advocacy Coalition Framework. In mathematics education, there may be groups like the teacher organizations, researchers, the policy-makers, and the representatives of the companies formed to advocate for the reforms that they are interested in and which are coherent with their core values and interests (Cairney, 2012; Adams & Boylan, 2023). The Policy Cycle Model dissects the process of policy development into the following stages: agenda-setting, policy formulation, decision-making, implementation, and evaluation.

This cyclical approach can be used to analyze how mathematics education policies are formulated, implemented, and changed by feedback and outcomes. The Multiple Streams Framework (MSF), first proposed by Kingdon (1984), has been widely used in public policy scholarship; as Cairney and Jones (2016) note, it remains popular because of its intuitive appeal, flexibility, and low barrier to entry for empirical research. Adams and Boylan (2023) has reported that the utilization of policy analysis frameworks in mathematics education differs in many ways, major among them being: (1) Chronological Mapping that follows changes in policy over a specific period to detect tendencies and patterns in mathematics education; (2) Case Studies that only study specific reforms, like the changes in national curricula, to understand the drives, the levers, and the impacts; (3) Systemic Patterns that show the systemic problems that keep coming back, as, for example, the impact of political actors, or the balance between prescription, and teacher autonomy; (4) International Horizon Scanning, a form of research that delves into cross-national comparisons of innovations and policy evolutions to set future directions.

Furthermore, little is known about the application of these policy analysis frameworks in mathematics education research. For instance, the Mathematical Futures Programme of the Royal Society in England has employed these frameworks to analyze the path of mathematics curriculum reforms, professional development initiatives, and assessment policies, which in turn highlighted the multifaceted and very often debatable nature of policy change (Boylan et al., 2023). Identical dissections are required in such cases as in Ghana, where it is a unique combination of historical, cultural, and political factors that determines the amplitude of the policy reforms.

The review present the pedagogical methodological issues in mathematics education as the main research area to be addressed. There is continuous problem of matching research and policy that is still interesting, with the possibility of maintaining the relevance of the research and its accessibility to professional practitioners and policymakers. It refers to how results are disseminated, types of evidence used in policy networks, and the organizational forms that inhibit or help the connections between research and policy. This challenge is evident not only in Ghana, where the transfer of policy research into practice is constrained by political priorities, financial limitations, and structural features of the education system. In addition to political priorities, financial limitations, and the educational system, teachers play a key role in such a process of change.

Furthermore, the review will consider the implications of policy analysis for equity and social justice in mathematics education. As Nguyen (2024) observes, discourses about equity in mathematics are often narrowly framed in terms of access and achievement, overlooking broader questions of representation, participation, and power. Policy analysis frameworks can help surface these issues, enabling a more critical and inclusive approach to policy research and development.

This systematic review is inspired by the need to expose the state of matters concerning the issue of policy analysis frameworks through a lens of mathematics education research, specifically of Ghanaian and open-access international policies. The study aims to add its findings to the pool of already existing systematic reviews, pointing out what is still undiscovered, emphasizing challenges, and recommending future research and effective practice. The paper stems from the understanding that policy acts as a catalyst for the modification of the education sector and that policy analysis of high quality and suitable for adverse conditions is indispensable if the possible revolution in mathematics education is to occur.Hence, this systematic review synthesize the current research on the application of policy analysis frameworks in mathematics education, concentrating on the policies of Ghana as well as those that are available internationally. The review aims to answer to the following questions:

1. What policy analysis frameworks are most commonly used in mathematics education research?

2. How are these frameworks applied in the studies?

2. Method

2.1. Design

A comprehensive systematic literature review (SLR) was conducted to ensure the research questions are answered and involves gathering publications that have some relevance to the subject according to predetermined eligibility criteria (Mengist et al., 2020). The present study focus on relevant publications between the years 2000 and 2025. Following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, a standardized, transparent methodology, quality and replicability of the review process were ensured (Conde et al., 2020; Moher et al., 2015). The PRISMA framework consists of four key stages (identification, screening, eligibility, and inclusion), which are explained in the paper. Alongside its role in organizing and summarizing the literature, the PRISMA framework was employed to structure the additional search focused specifically on identifying studies that apply policy analysis frameworks in mathematics education. Figure 1 shows the PRISMA flow chart

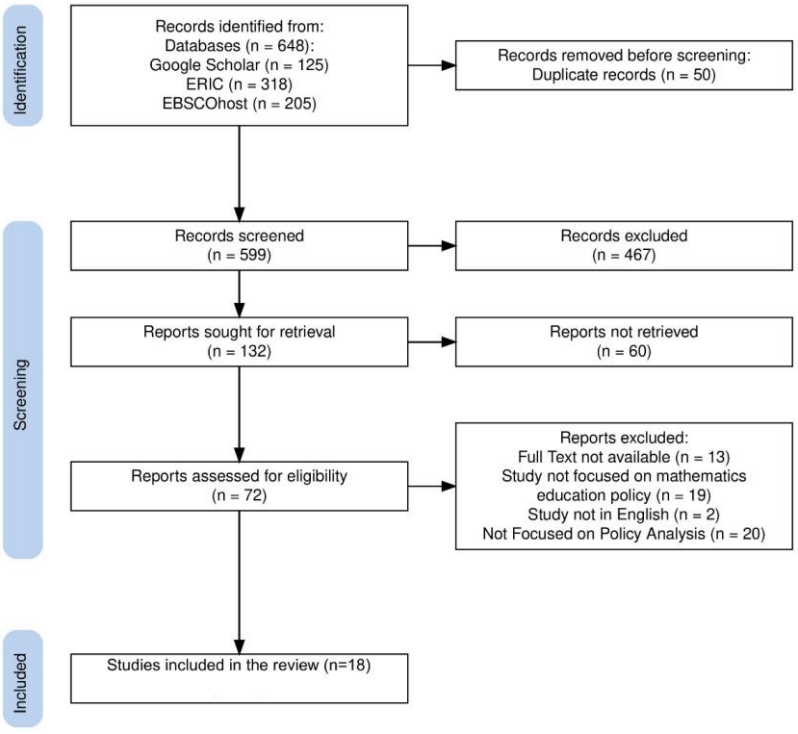

Figure 1*: PRISMA Flow Diagram of Literature Search (Page. et al., 2021)*

2.2. The Systematics Review Process

Identification

The search for literature was done in three databases, which are: Google Scholar, the Education Resources Information Center (ERIC), and EBSCOhost. In order to meet the goal of the review, a keyword-based search strategy was created for each database (see Table 1), rsulting in a total of 648 studies, with Google Scholar producing 125, ERIC providing 318, and EBSCOhost yielding 205. %0 of these records were duplicates and were therefore excluded.

Table 1: Search Strategy for the Databases

Database	**Search String**
Google Scholar	*allintitle: "Policy Analysis Frameworks"OR"Policy Analysis"OR"Policy"AND"Mathematics Education"OR"Mathematics Education Research"*
ERIC	*Title: ("Policy Analysis Frameworks"OR"Policy Analysis"OR"Policy")AND("Mathematics Education"OR"Mathematics Education Research")*
EBSCOhost	*TI "Policy Analysis Frameworks"OR"Policy document"OR "Policy"OR"Policy brief"OR"Policies" AND TI "Mathematics Education"OR"Mathematics Education Research"*

Note: The quotation marks mean that the results returned publication included these phrases rather than that contained each word individually.

2.3. Screening Process and Eligibility Criteria

After the initial database searches, 648 records were identified. Following the removal of 50 duplicates, 598 publications were screened for eligibility. To ensure transparency and reliability, the screening was independently conducted by two reviewers. In the first part, both reviewers screened title and abstract against the selection criteria. This led to the exclusion of 467 publications, and 132 publications that were eligible for retrieval. Out of the 132, sixty (60) could not be retrieved because of unavailability or not having access to the full text. The remaining 72 publications were retrieved and uploaded into Sysrev, a web-based screening tool designed to review articles. The full test of the 72

publications were independently evaluated. Any disagreement about eligibility was resolved through discussion amongst the reviewers and, in cases where agreement was still not reached, a third reviewer was consulted. This stage resulted a final set of 18 publications that reviewers agreed to be included.

Table 2: Selection Criteria

Inclusion Criteria	**Exclusion Criteria**
Publication between 2000 and 2025	Publication before 2000
Policy analysis publication in mathematics education	Non-Mathematics Education Policy Analysis Publication
Publication in English Language	Non-English Language publication
Full-text available	

After confirming the 18 studies, data were systematically extracted from the studies via a structured form developed in Sysrev. This form included bibliographic information, including author, year, and publication type; country or jurisdiction of focus; study aims and methods; the policy documents that were analyzed; the policy-analysis framework that was applied; and key findings. To fortify rigor, both reviewers independently coded the data, highlighting any discrepancies or ambiguous data points, which were subsequently discussed and agreed upon.

The information from the studies was coded using a deductive–inductive approach. In the deductive phase, studies were mapped to the four frameworks in Adams and Boylan (2023): Case Studies, Systemic Patterns, Chronological Mapping, and International Horizon Scanning. Inductively, additional themes began to emerge, including equity, teacher professional development, assessment, and policy enactment. This method enabled structured categories and for new data to be included, which is described in the Results section.

3. Results

This purposeful review generated eighteen publications that fit the inclusion criteria. In order to make sense out of the studies, we undertook a narrative qualitative synthesis. The synthesis was conducted in two stages. First, the studies were deductively sorted to correspond with the four policy-analysis frameworks outlined by Adams and Boylan (2023): Case Studies (CS), Systemic Patterns (SP), Chronological Mapping (CM), and International Horizon Scanning (IHS). We then undertook an inductive reading of the studies to determine patterns such as equity, teacher professional development,

assessment reforms, and policy enactment processes. This dual approach permitted movement beyond mere descriptions of studies counted to interpret how scholars applied the frameworks in their studies. Thus, findings are presented in three sections. The first section involves the characteristics of the publications including its types, and countries of origin. The second section represents the frequency of the frameworks utilized in the identified studies. Finally, the last section discusses the applications of the frameworks in each of the studies.

3.1. Characteristics of publications

The distribution of the type of the 18 publications selected for review is shown in Figure 2. The majority (14) of the publications were articles in a journal, two (2) dissertations, one (1) online document, and a book each. The countries in which these 18 selected publications conducted the study on their policy in mathematics education are presented in Figure 3. The publications reviewed featured England and the USA more than any other country (five times). All other countries, including Ghana, were featured in only one study, and Sweden was featured twice.

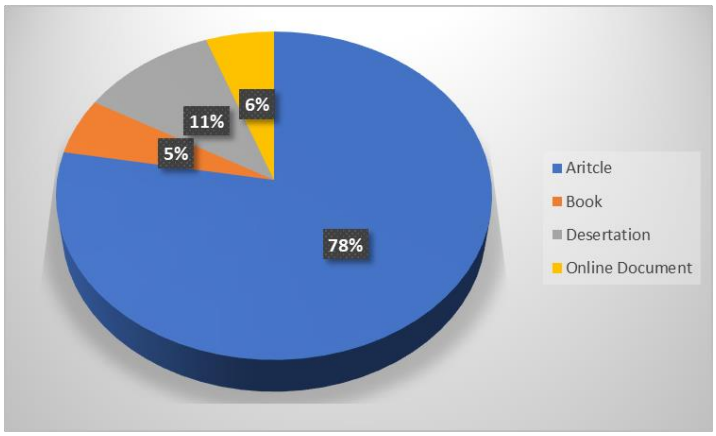

Figure 2*:Distribution of Types of Publications*

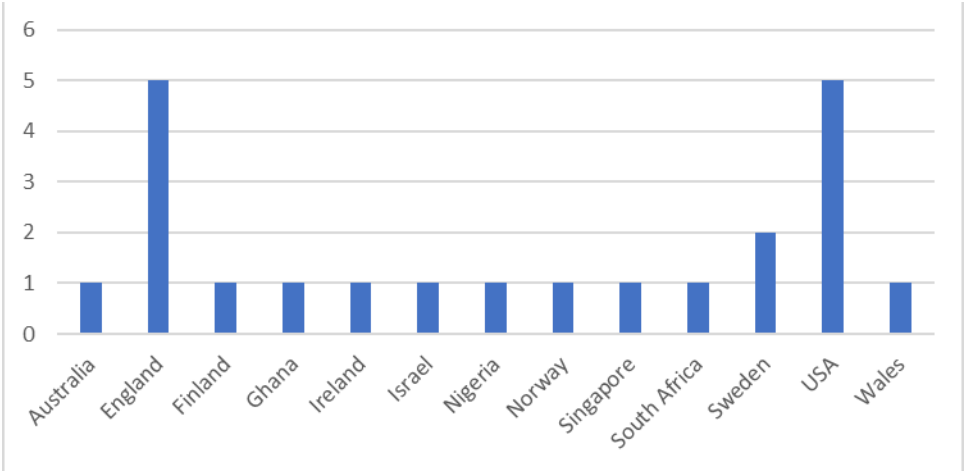

Figure 3: *Distribution of Countries the Publications was done on*

3.2. Prevalent Policy analysis frameworks in mathematics education research

To answer the question, "What policy analysis frameworks are most commonly used in mathematics education research?" the publications were classified based on the Adams and Boylan (2023) ways of applying policy analysis frameworks in mathematics education. Thus, Chronological Mapping (CM), Case Studies (CS), Systemic Patterns (SP), and International Horizon Scanning (HIS). The count of the publications for each of these categories is presented in Figure 4.

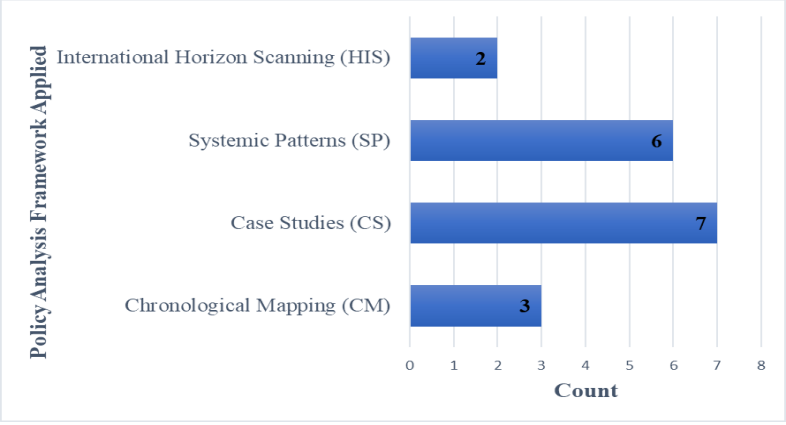

Figure 4*: Distribution of Policy Analysis Frameworks Used*

Seven of the publications employed a case study policy analysis framework. Extracted from Adams and Boylan. (2023), these studies examined distinct national-level

interventions, like curriculum overhaul to mature insights or developmental exercises to professional understanding, which drove impacts. Six publications were in line with the Systemic Patterns (SP), these publications identified recurring systemic issues, such as the influence of political actors or the balance between prescription and teacher autonomy. Three (3) and Two (2) of the publications followed the Chronological Mapping (CM) and International Horizon Scanning (HIS), respectively.

3.3. Application of the policy analysis frameworks

To answer this question, the specific studies that used the various ways of policy analysis frameworks have been presented in Table 3 for a discussion on how these frameworks were applied in these studies. Hughes (2025), Hawks (2019), and Travers (2010) used the Chronological Mapping (CM) policy analysis framework. The dissertation by Hawks (2019) explored the concept of "achievement as accountability" in U.S.A. mathematics education policy, specifically focusing on how it intersects with race and racialization. This dissertation critiques existing deficit narratives that define who is considered capable of mathematics education, which reveals the persistence of racism in policy. This approach of analysing a policy is deeply embedded in the Chronological mapping. The study specifically employs political discourse analysis to examine historical legislation and its impact on the perception of mathematics in K-12 education. Similarly, Hughes (2025) critiques the prevailing policy discourse surrounding indigenous education, arguing that it prioritizes economic efficiency over social justice and equity. This was done by analysing two key policy documents, which reveal a skew towards dominant educational constructs, with insufficient attention to cultural contributions and identity dimensions in mathematics education. Travers (2010) critiques the learning-support policy for mathematics in Irish primary schools, highlighting inequitable access to support between designated disadvantaged and non-designated schools. This paper employs a critique of key policy documents, research reports, evaluations, and Department of Education and Science (DES) guidelines to schools as its primary method of analysis. The analyses also included statistical data on pupil achievement and access to learning support in mathematics.

Studies such as Hed et al. (2024), Feniger (2020), Noyes and Dalby (2020), Dalby and Noyes (2018), Fosse et al. (2018), Ugwu (2011), and Castro et al. (2010) applied the Case Studies (CS) policy analysis framework. Hed et al. (2024) investigated the transition from secondary to tertiary mathematics education in Sweden, focusing on the mathematical competencies of incoming engineering students from 2006 to 2021. This was accomplished by employing a diagnostic test to assess the mathematical competencies of beginning engineering students at Umeå University, emphasizing solution frequency, which is the percentage of the total score achieved by students. Noyes and Dalby (2020)

also employed the case study analysis framework by exploring the organization and management of mathematics qualifications in further education colleges, concentrating on the progression pathways between different mathematics qualifications. Consequently, a qualitative methodology involving six in-depth case studies of further education (FE) college providers was initiated in December 2017, with an additional 23 providers added in May 2018, resulting in a total of 32 college case studies conducted. This research aimed to address key questions regarding the management of mathematics in educational settings.

Available online at ijci.wcci-international.org

International Journal of Curriculum and Instruction 18(3)
(2026) 397–418

IJCI
International Journal of Curriculum and Instruction

Table 3: Policy analysis frameworks commonly used in mathematics education research

Chronological Mapping (CM)	**Case Studies (CS)**	**Systemic Patterns (SP)**	**International Horizon Scanning (HIS)**
(n=3)	(n=7)	(n=6)	(n=2)
1. "A Study of Race and Equity in US Mathematics Education Policy"(Hawks, 2019) 2. "Equitable outcomes and indigenous learners of mathematics: deconstructing Australian education policy" (Hughes, 2025). 3. "Learning Support Policy for Mathematics in Irish Primary Schools: Equal	1. "Evidence-based decision making or a tunnel vision effect? TIMSS, problem definition and policy change in Israeli mathematics education" (Feniger, 2020). 2. "Examining the Process of Developing a Research-Based Mathematics Curriculum and Its Policy Implications" (Castro et al., 2010). 3. "Mathematics education policy enactment in England's Further Education colleges" (Dalby & Noyes, 2018) 4. "Mathematics in England's Further Education Colleges: an analysis of policy enactment and practice" (Noyes & Dalby, 2020)	1. "Policy and the Standards Debate: Mapping Changes in Assessment in Mathematics" (Lerman & Adler, 2016) 2. "PISA and policy-borrowing: A philosophical perspective on their interplay in mathematics education" (Cantley, 2019). 3. "Connecting the stakeholders: Departments, policy, and research in undergraduate mathematics education" (Apkarian et al., 2021) 4. "In-Service Training Programmes for	1. "Comparing Nebraskan and Finnish Education Policy and Its Impacts on Mathematics Teaching" (Tyler, 2019) 2. "Primary Mathematics Pedagogy at the Intersection of Education Reform, Policy, and Culture: Comparative Insights from Ghana, Singapore, and the US" (Murray &

Access but Unequal Needs" (Travers, 2010)	5. "Changes in mathematical skills among freshman engineering students" (Hed, et al., 2024) 6. "Mathematics as the Trojan Horse in Norwegian Early Childhood Policy?" (Fosse, et al., 2018) 7. "Reappraising the current national policy on education for functionality and self–reliance: Issues and challenges for mathematics education" (Ugwu, 2011)	Mathematics Teachers Nested in Transnational Policy Discourses" (Erixon & Wahlström, 2016) 5. "Examining Mathematics Teacher Content Knowledge: Policy and Practice" (Harrell & Eddy, 2012) 6. "Policy-based evidence: the schools inspectorate in England, research and school mathematics policy" (Compton & Boylan, 2024)	Allotey,2021)

Note that all citations are hyperlinked to their sources

Available online at ijci.wcci-international.org

International Journal of Curriculum and Instruction 18(3) (2026) 397–418

IJCI
International Journal of Curriculum and Instruction

Feniger (2020) reported how the 1999 TIMSS results spurred the attention of Israeli policymakers towards curricular and pedagogical changes for mathematics education. This study is based on a case policy analysis using document analysis where policy documents received a critical gaze concerning their mathematics education policy vis-à-vis the TIMSS 1999 results and mathematics education policy in Israel between the years 2000 and 2010. This paved the way for the analysis of the framing of educational problems and the influence of international tests on policy discussions. However, the case analysis framework approach by Fosse et al. (2018) differs from the other studies. In this study, Critical Discourse Analysis (CDA) is used as its primary methodology to investigate the representations of mathematics education in Norwegian and OECD early childhood education and care (ECEC) policy documents. This approach aided investigation of the subtle shift in Norwegian early childhood education policy from a focus on play to a readiness-for-school approach, with mathematics education acting as a "Trojan horse" in this transition.

Ugwu (2011) also critiques the National Policy on Education (2004) in Nigeria, stating that its objectives are generally theoretical rather than practical. Castro et al. (2010) examined the development and revision process of the Math Trailblazers (MTB) curriculum and its alignment with research-based mathematics education reforms. This paper also employs case study methodology to investigate the research and revision process of the Math Trailblazers (MTB) curriculum. This approach allows for an in-depth examination of various documents, including revision drafts, research protocols, and communications among development and research teams. This is how these studies applied the case study policy analysis framework for the conduct of their studies.

The Systemic Pattern policy analysis framework was also employed in Compton and Boylan (2024), Apkarian et al. (2021), Cantley (2019), Erixon and Wahlström (2016), Lerman and Adler (2016), and Harrell and Eddy (2012). The following is how the systemic pattern analysis framework was used in the six (6) studies. Compton and Boylan (2024) also condemn the Ofsted review of maths, with its departure from academic convention and policy-based evidence. Apkarian et al. (2021) provide a report of the Mathematical Association of America's Precalculus to Calculus Conference results regarding the alignment and misalignment of priorities between mathematics departments, policy, and research in undergraduate mathematics education through thematic analysis to establish emergent themes from conference forums in which the

participants provided commentary and concerns regarding undergraduate mathematics education. Cantley (2019) employs a philosophical critique to challenge the Programme for International Student Assessment (PISA) and its policy implications for mathematics education. This drew on Ludwig Wittgenstein's later philosophy of mind to explore the limits of PISA's psychometric model, namely with respect to the measurement of mathematical capacity.

Erixon and Wahlström (2016) investigate the recontextualisation processes of transnational and national policy discourses regarding in-service training for mathematics teachers in Sweden. The Critical Discourse Analysis (CDA) as its primary methodology, characterized by a dialectical relationship between discourse and social elements. Lerman and Adler (2016) examined the influences on educational policy changes in mathematics assessment, focusing on the UK and South Africa. This paper employed a method of developing a graph to map influences on educational policy changes, particularly in mathematics assessment, by identifying agents and agencies involved in these changes. This approach provided a neutral tool for understanding the dynamics of educational change. Lastly, Harrell and Eddy (2012) investigated the alignment between mathematics teacher content knowledge, college coursework, and state certification exams, specifically the Texas Examination of Educator Standards (TExES). Their analysis included descriptive statistics and correlation tables to evaluate the alignment of coursework with TExES domains and standards.

Murray and Allotey (2021) and Tyler (2019) utilized the International Horizon Scanning framework for their studies in the following ways. Murray and Allotey (2021) wrote a monograph that examines primary mathematics education across Ghana, Singapore, and the USA, highlighting the impact of educational reforms, policies, and cultural contexts on teaching practices. This was a comparative analysis of educational policies and reforms in Ghana, Singapore, and the US, focusing on primary mathematics education that emphasizes the importance of comparative education in addressing global educational challenges and improving pedagogical practices. Tyler (2019) investigates the differences in education policy between Finland and Nebraska (a state in the USA), focusing on its impact on math teachers' daily work.

In the context of the eighteen studies, the predominant methodologies were case study and systemic pattern analysis with more emphasis on localized change and persistent structural problems. Chronological mapping was the least used method but provided important historical context to demonstrate changes in policy particularly around equity. Horizon scanning was the least used but offered some comparative perspectives that

could help teachers or researchers borrow or adapt policies for their contexts. The disproportionate use of these methodologies suggest that mathematics education research has made advancements in critiquing national reform, but has yet to fully leverage frameworks that address longitudinal change or an international vantage point. This is especially salient in the context of Ghana where horizon scanning and chronological mapping could allow for deepened understandings of how global reforms are situated within local contexts.

Consequently, the results of this review directly answer both research questions by first demonstrating the most commonly used policy analysis framework for mathematics education. Additionally, findings illustrate how these frameworks have been applied and used across studies and contexts.

3.4. Implication

This review presents a range of implications for the development of mathematics education research and policy. The pre-eminence of case study and systemic pattern gives the impression that the majority of studies have been concerned with either local or recurring structural conditions. While this adds some important details, it is a missed opportunity to speculate about long-term trajectories or knowledge exchange across nations which could have been provided through the notion of chronological mapping and horizon scanning. These ideas suggest a broader and responsible use of policy-analysis frameworks in mathematics education research.

The review contributes to existing literature through systematically synthesizing how mathematics education research has used policy analysis and theories based on these frameworks under the umbrella of mathematics education. Previous studies focused heavily on surveys of curriculum reform or teacher development, so this review illustrates that a consideration of policy analysis frameworks can also uncover dynamics of power, equity matters or global rationales that inform ways countries arbitrate national mathematics policies, including policy aspirations. The case of Ghana in this review highlights the complexity of mathematics education reform at the confluence of local priorities with global accountability rationales such as TIMSS and PISA. New Zealand is often cited as a progressive education country and they engage with TIMSS and PISA but the inclusion of Ghana as a case gives a lower income country perspective that is often not afforded, especially within mathematics education.

Taking into consideration these findings, the report makes several recommendations. First, researchers should utilize a broader selection of policy-analysis frameworks (e.g., horizon scanning and chronological mapping) to incorporate both international

similarities, trends and timelines, and long-term reforms as key features of policy analysis. Second, policy makers, particularly in Ghana and similar contexts, should utilise these frameworks to provide innovative ideas in the design and evaluation of reforms as they seek to ensure they achieve global standards while simultaneously addressing local needs and equity concerns. And lastly, the frameworks utilized could also be used by teacher educators and professional organizations for the purposes of critically engaging in reforms that do more than scrape the surface of implementation and actually consider the implications of the reforms for practice.

4. Conclusions

This review underscores the value of the policy analysis frameworks used in mathematics education research (Chronological Mapping (CM), Case Studies (CS), Systemic Patterns (SP), and International Horizon Scanning (HIS)), especially for informing policy development and evaluation in mathematics education. This systematic review reveals a methodological imbalance in mathematics-education policy research, with extensive attention to local reforms and structural challenges, but minimal engagement with frameworks that illuminate longitudinal policy change or cross-national insights. Policymakers and researchers in Ghana and other African countries should adopt these frameworks to enhance evidence-based decision-making. This systematic review used a comprehensive search strategy and a rigorous screening and selection procedure. However, the potential of publication bias, the restriction on language, and heterogeneity of publications included limit the feasibility of a quantitative meta-analysis of the study. Future reviews could explore the longitudinal impacts of policy reforms and the perspectives of diverse stakeholders.

In conclusion, policy analysis frameworks play a crucial role in advancing mathematics education research and policy, offering structured approaches for analyzing complex policy environments. Their application in Ghana, in particular, is minimal in terms of important insights into policy development, implementation, and outcomes. There is a need for mathematics education researchers in Ghana to use these frameworks to conduct studies that will strengthen the evidence base for effective mathematics education policy.

References

Adams, G., & Boylan, M. (2023). Landscaping Mathematics Education Policy: Horizon scanning of international policy initiatives. https://shura.shu.ac.uk/32348/1/Adams-LandscapingMathematicsEducation%28VoR%29.pdf

Adu-Gyamfi, S., Donkoh, W. J., & Addo, A. A. (2016). Educational Reforms in Ghana: Past and Present. Journal of Education and Human Development, 5(3), 158–172. https://doi.org/10.15640/jehd.v5n3a17

Agbozo, K. K., Bonyah, E., & Clark, L. J. (2024). Changes in the Ghanaian Schools' Mathematics Curriculum – Exploring the Need to Raise Awareness in the Integration of the History of Mathematical Concepts as a Pedagogical Tool. Educational Innovations and Emerging Technologies, 4(1), 1–12. https://doi.org/10.35745/eiet2024v04.01.0001

Apkarian, N., Kirin, D., Gehrtz, J., & Vroom, K. (2019). Connecting the Stakeholders: Departments, Policy, and Research in Undergraduate Mathematics Education. *PRIMUS*, *31*(1), 17–36. https://doi.org/10.1080/10511970.2019.1629135

Ball, S. J. (2012). *Global education inc.: New policy networks and the neo-liberal imaginary*. Routledge. https://doi.org/10.4324/9780203803301

Cairney, P. (2012). Complexity Theory in Political Science and Public Policy. Political Studies Review, 10(3), 346-358. https://doi.org/10.1111/j.1478-9302.2012.00270.x

Cairney, P., & Jones, M. D. (2016). Kingdon's Multiple Streams Approach: What Is the Empirical Impact of this Universal Theory? Policy Studies Journal, 44(1), 37–58. DOI: 10.1111/psj.12111

Cantley, I. (2018). PISA and policy-borrowing: A philosophical perspective on their interplay in mathematics education. *Educational Philosophy and Theory*, *51*(12), 1200–1215. https://doi.org/10.1080/00131857.2018.1523005

Castro Superfine, A., Randall Kelso, C., & Beal, S. (2009). Examining the Process of Developing a Research-Based Mathematics Curriculum and Its Policy Implications. Educational Policy, 24(6), 908-934. https://doi.org/10.1177/0895904809351690

Chen, X., Xie, H., Zou, D., & Hwang, G. J. (2020). Application and theory gaps during the rise of artificial intelligence in education. Computers and Education: Artificial Intelligence, 1, 100002. https://doi.org/10.1016/j.caeai.2020.100002

Compton, A., & Boylan, M. (2024). Policy-based evidence: the schools inspectorate in England, research and school mathematics policy. *Research in Mathematics Education*, 1–22. https://doi.org/10.1080/14794802.2024.2418082

Dalby, D., & Noyes, A. (2018). Mathematics education policy enactment in England's Further Education colleges. *Journal of Vocational Education & Training*, *70*(4), 564–580. https://doi.org/10.1080/13636820.2018.1462245

Erixon, E. L., & Wahlström, N. (2015). In-service training programmes for mathematics teachers nested in transnational policy discourses. European Journal of Teacher Education, 39(1), 94–109. https://doi.org/10.1080/02619768.2015.1101062

Feniger, Y. (2018). Evidence-based decision making or a tunnel vision effect? TIMSS, problem definition and policy change in Israeli mathematics education. *Critical Studies in Education*, *61*(3), 363–379. https://doi.org/10.1080/17508487.2018.1448877

Fosse, T., Lange, T., Hope Lossius, M., & Meaney, T. (2018). Mathematics as the Trojan horse in Norwegian early childhood policy? *Research in Mathematics Education*, *20*(2), 166–182. https://doi.org/10.1080/14794802.2018.1473162

Gutiérrez, R. (2013). Why (urban) mathematics teachers need political knowledge. Journal of Urban Mathematics Education, 6(2), 7–19. Retrieved from https://files.eric.ed.gov/fulltext/EJ1085791.pdf

Haddaway, N. R., Page, M. J., Pritchard, C. C., & McGuinness, L. A. (2022). PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis Campbell Systematic Reviews, 18, e1230. https://doi.org/10.1002/cl2.1230

Han, S., & Suh, H. (2020). The effects of shadow education on high school students' creative thinking and academic achievement in mathematics: the case of the Republic of Korea. *Educational Studies*, *49*(2), 314–333. https://doi.org/10.1080/03055698.2020.1850427

Harrell, P. E., & Eddy, C. M. (2012). Examining Mathematics Teacher Content Knowledge: Policy and Practice. Policy Futures in Education, 10(1), 103-116. https://doi.org/10.2304/pfie.2012.10.1.103

Hawks, M. C. (2019). A Study of Race and Equity in US Mathematics Education Policy. https://doi.org/10.7939/r3-enbb-8w92

Hed, L., Åhag, P., & Norqvist, M. (2024). Changes in mathematical skills among freshman engineering students. *International Journal of Mathematical Education in Science and Technology*, 1–15. https://doi.org/10.1080/0020739X.2024.2404427

Hodgen, J., Foster, C., & Brown, M. (2022). Low attainment in mathematics: An analysis of 60 years of policy discourse in England. *The Curriculum Journal*, *33*(1), 5-24. https://doi.org/10.1002/curj.128

Hoyles, C., Ferrini-Mundy, J. (2012). Policy Implications of Developing Mathematics Education Research. In: Clements, M., Bishop, A., Keitel, C., Kilpatrick, J., Leung, F. (eds) Third International Handbook of Mathematics Education. Springer International Handbooks of Education, vol 27. Springer, New York, NY. https://doi.org/10.1007/978-1-4614-4684-2_16

Hughes, A. (2025). Equitable outcomes and indigenous learners of mathematics: deconstructing Australian education policy. *International Journal of Inclusive Education*, *29*(3), 274-290. https://doi.org/10.1080/13603116.2022.2127490

Kadijevich, D. M., Stephens, M., Solares-Rojas, A., & Guberman, R. (2023). Impacts of TIMSS and PISA on mathematics curriculum reforms. In *Mathematics Curriculum Reforms Around the World: The 24th ICMI Study* (pp. 359-374). Cham: Springer International Publishing.

Kaur, B., Toh, T. L., & Tay, E. G. (2023). The evolution of mathematics education research in Singapore. In B. Atweh, L. Fan, & C. P. Vistro-Yu (Eds.), Asian research in mathematics education: Mapping the field (pp. 43-65). Springer. https://doi.org/10.1007/978-981-99-0643-7_3

Ministry of Education, Ghana (2019). Basic Education Curriculum. *Ministry of Education*. Retrieved from https://nacca.gov.gh/wp-content/uploads/2019/04/SCIENCE-UPPER-PRIMARY-B4-B6.pdf

Lerman, S., & Adler, J. (2016). Policy and the standards debate: mapping changes in assessment in mathematics. *Research in Mathematics Education*, *18*(2), 182–199. https://doi.org/10.1080/14794802.2016.1174620

Lingard, B., & Sellar, S. (2016). Globalization and education policy. In K. Mundy, A. Green, B. Lingard, & A. Verger (Eds.), *The handbook of global education policy* (pp. 353–373). Wiley-Blackwell. https://doi.org/10.1002/9781118468005.ch18

Lotey, E. K., Arthur, Y. D., Gordon, J. F., & Adu-Obeng, B. (2023). Modeling Basic School Teachers' Acceptance of Instructional Technology in Advancing Mathematical Pedagogy in Ghana. Contemporary Mathematics and Science Education, 4(1), ep23006. https://doi.org/10.30935/conmaths/12811

Mengist, W., Soromessa, T., & Legese, G. (2020). Method for conducting systematic literature review and meta-analysis for environmental science research. *MethodsX*, *7*, 100777. https://doi.org/10.1016/j.mex.2019.100777

Mereku, D. K. (2023). Modern Mathematics Curriculum Reforms in Ghana: UK and USA Influences. In D. De Bock (Ed.), History of Mathematics Education, pp. 489–504. Springer. https://doi.org/10.1007/978-3-031-11166-2_24

Mohr, S., Kühl, R., 2021. Acceptance of artificial intelligence in German agriculture: an application of the technology acceptance model and the theory of planned behavior. Precis. Agric. https://doi.org/10.1007/s11119-021-09814-x

Murray, S., & Allotey, P. (2021). Primary Mathematics Pedagogy at the Intersection of Education Reform, Policy, and Culture: Comparative Insights from Ghana, Singapore, and the US (1st ed.). Routledge. https://doi.org/10.4324/9781003172468

Myers, M., Kokka, K., & Gutiérrez, R. (2023). Maintaining tensions: Braiding as an analogy for mathematics teacher educators' political work. Education Sciences, 13(11), 1100. https://doi.org/10.3390/educsci13111100

Nguyen, P. (2024). School mathematics as context: examining discourses about the subject in district policymaking. *Educ Stud Math* **117**, 485–509. https://doi.org/10.1007/s10649-024-10348-y

Noyes, A., & Dalby, D. (2020, February). *Mathematics in England's Further Education Colleges: an analysis of policy enactment and practice*. Retrieved from https://www.nottingham.ac.uk/research/groups/crme/documents/mifec/interim-report-2.pdf

Ozga, J. (2000). *Policy research in educational settings: Contested terrain*. Open University Press.

Pais, A., & Valero, P. (2012). Researching research: mathematics education in the Political. Educational Studies in Mathematics, 80(1–2), 9–24. https://doi.org/10.1007/s10649-012-9399-5

Sanderson, W. C. (2004). [Review of *Shaping the Next One Hundred Years: New Methods for Quantitative Long-Term Policy Analysis*, by R. J. Lempert, S. W. Popper, & S. C. Banks]. *Population and Environment*, *26*(2), 173–176. http://www.jstor.org/stable/27503915

Travers, J. (2010). Learning support policy for mathematics in Irish primary schools: Equal access but unequal needs. *Irish Educational Studies*, *29*(1), 71-80. https://doi.org/10.1080/03323310902884342

Tyler, E. (2019). Comparing Nebraskan and Finnish education policy and its impacts on mathematics teaching. Undergraduate Honors Thesis. *University of Nebraska - Lincoln*.

Ugwu, P. N. (2011). Reappraising the current national policy on education for functionality and self–reliance: Issues and challenges for mathematics education. *Journal of Qualitative Education*, *7*(1), 143-144. https://www.globalacademicgroup.com/journals/qualitative%20education/REAPPRAISING%20THE%20CURRENT%20NATIONAL%20POLICY.pdf