NIGERIAN ONLINE JOURNAL OF
EDUCATIONAL SCIENCES AND TECHNOLOGY
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Trends in Research in Evaluation and Curriculum in Mathematics Education

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Abstract

This study conducted a content analysis on trends in evaluation and curriculum research in mathematics education from 2007 to 2023. A sample of thirty (30) related studies was conducted, selected from journal articles available online from Google Scholar, analyzed and coded through content analysis in terms of their contexts, sample size and type, data collection tools and data analysis techniques. The results showed that; evaluation studies were more prominent than curriculum studies in mathematics education, more preference for teachers and students' views as sample types thus neglecting other stakeholders; qualitative research methods were mainly employed; documents and questionnaires were the dominant data collection tools in the qualitative and quantitative research respectively, content analysis was dominant in studies which used qualitative analysis techniques, while frequency/percentage and mean/standard deviation, t-test and ANOVA were mostly utilized as descriptive and inferential quantitative analysis techniques respectively. Therefore, it is concluded that the studies on evaluation and curriculum in mathematics education conducted in Nigeria outnumbered the ones in other countries and studies were more concerned with the views of mathematics education teachers and students.

Keywords: Trends, Research, Evaluation, Curriculum development. Curriculum design

Introduction

Mathematics education has consistently been at the forefront of efforts to develop logical reasoning, analytical skills, and problem-solving capabilities. The relevance of mathematics extends beyond academic performance; it is crucial for technological innovation, economic development, and informed citizenship. Thus, effective evaluation methods and robust curriculum designs are critical in fostering mathematical competence and ensuring equitable access to quality education (Niss & Højgaard, 2019). Over the past two decades, educational research has increasingly focused on two interrelated domains in mathematics education: evaluation and curriculum design. Evaluation serves as a mechanism for measuring learning outcomes, diagnosing challenges, and guiding instructional strategies. On the other hand, curriculum design

determines the structure and content of mathematics education, aligning with societal needs, technological advancements, and pedagogical theories (English, 2021). The interplay between evaluation and curriculum design has gained attention due to its significant implications for student outcomes. Misaligned evaluation practices can hinder the effectiveness of even the most well-designed curricula, while poorly constructed curricula may fail to support meaningful assessments. This paper examines how these two domains converge to address contemporary challenges in mathematics education, emphasizing trends in research, emerging practices, and future directions.

The digital age has significantly influenced curriculum development in mathematics education. Educators are increasingly integrating digital technologies and resources into curricula to enhance learning experiences. This shift towards digital integration aims to make learning more interactive and accessible, catering to diverse learning styles and needs. Studies have shown that incorporating technology can lead to improved student engagement and understanding of mathematical concepts (Akinoso, 2023; Ali, Yasmeen, & Munawar, 2023).

Another notable trend is the adoption of learner-centered and personalized approaches to curriculum design. This involves tailoring educational experiences to individual student needs (Akinsola & Awofala, 2008, 2009; Awofala, Balogun, & Olagunju, 2011; Awofala, Fatade, & Olaoluwa, 2013; Awofala, 2011; Akinoso, 2015; Akinoso, 2016; Akinoso, Agoro, Alabi, 2020; Akinoso, Olafare, Oye-Akinoso, 2021), allowing for differentiated instruction that can address varying levels of ability and learning styles (Awofala & Lawani, 2020). Such approaches have been linked to increased motivation and better learning outcomes in mathematics (Rahman & Ahmar, 2017). Mathematics education plays a crucial role in fostering critical thinking, problem-solving, and analytical skills essential for scientific and technological advancement. Over the past few decades, the field of mathematics education has witnessed significant shifts in curriculum design and evaluation methodologies, reflecting broader changes in educational research and policy. These shifts are influenced by factors such as globalization, technological advancements, and a growing emphasis on competency-based learning. Recent studies indicate that educational reforms in mathematics must align with 21st-century skills, integrating digital tools, innovative teaching strategies, and assessment models that enhance student engagement and performance (OECD, 2022).

In Nigeria, the importance of mathematics cannot be overemphasized, as it is a core subject at all levels of education. However, concerns about declining student performance in mathematics have led to increased research on curriculum effectiveness and evaluation strategies. Scholars emphasize that continuous assessment, adaptive learning approaches, and formative evaluation play vital roles in improving students' mathematics proficiency (Corrêa & Haslam, 2021). Furthermore, the rapid growth of artificial intelligence (AI) and machine learning (ML) applications in education has opened new avenues for curriculum innovation, with studies highlighting their potential to personalize learning experiences and provide real-time feedback (Erşen & Ergül, 2022). Globally, mathematics education is undergoing a paradigm shift from traditional rote learning to more interactive, inquiry-based approaches (Akinoso, & Awofala, 2021). The introduction of game-based learning, computational thinking, and flipped classrooms has been found to enhance student engagement and conceptual understanding (Otajonova, 2025). Comparative research shows that countries with well-structured and frequently updated mathematics curricula tend to perform better in international assessments such as the Programme for International Student Assessment (PISA) (OECD, 2022). This underscores the necessity for

continuous curriculum evaluation to ensure alignment with global educational standards and emerging industry requirements.

This paper explores recent trends in research on evaluation and curriculum in mathematics education, with a specific focus on Nigeria and other countries. It examines how innovative assessment methods, curriculum reforms, and technology-driven teaching strategies are shaping the future of mathematics education. By synthesizing insights from contemporary studies, this paper aims to provide educators, policymakers, and researchers with a comprehensive understanding of the evolving landscape of mathematics education and its implications for student success in the 21st century. Since the paper checks for recent trends in evaluation and curricolom in mathematics education, there is a need to discuss some effective evaluation strategies in Mathematics Education.

Evaluation Strategies in Mathematics Education

Effective evaluation strategies are crucial for assessing and enhancing student performance in mathematics. Formative evaluation methods, which involve continuous assessment and feedback, have gained prominence. These strategies provide ongoing insights into student understanding, allowing educators to adjust instruction methods accordingly (Awofala, Fatade, & Ola-Oluwa, 2012; Lawal & Awofala, 2021). Research indicates that formative assessments can lead to significant improvements in student achievement by identifying learning gaps and informing targeted interventions (Awofala, & Olaniyi, 2023). Awofala (2020) noted that the computer-based testing reduced anxiety among students of mathematics. In Nigeria, studies have explored the impact of formative evaluation strategies on senior secondary school students' achievement in mathematics. Findings suggest that when teachers employ regular formative assessments, students demonstrate enhanced understanding and performance in mathematical concepts. This underscores the importance of integrating continuous assessment practices into the teaching process to foster better learning outcomes (Akinoso, & Ogunleye, 2021; Awofala, & Olaniyi, 2023) and promote 21st-century skills needed in the world of work (Awofala et al., 2019).

Implementation Challenges and Innovations

Implementing innovative curricula and evaluation methods in mathematics education is not without challenges. Barriers such as inadequate resources, lack of teacher training, and resistance to change can hinder effective implementation. Addressing these challenges requires comprehensive strategies, including professional development for educators, investment in educational resources, and fostering a culture that embraces change and innovation (Umeodinka, Adio & Igwe, 2023). Innovations such as game-based learning have emerged as effective tools in mathematics education. Game-based learning incorporates educational games into the curriculum, making learning more engaging and interactive. Systematic reviews have shown that game-based learning can improve student motivation and achievement in mathematics, providing a practical application of theoretical concepts (Erşen & Ergül, 2022).

Research Questions

The main purpose of this study is to conduct a critical review of the studies on curriculum and evaluation in mathematics education in order to find out the general characteristics of the studies. Based on this purpose, the study attempted to answer the following questions:

1. What are the characteristics of the studies on curriculum and evaluation in mathematics education with respect to context, sample type, sample size, research method, data collection tools and data analysis techniques?
2. What is the general pattern of the findings of the studies on curriculum and evaluation in mathematics education?

Method

This study conducted a content analysis, a statistical technique involved in extracting and combining studies to produce a summary result. The researcher used the process of categorizing verbal or behavioral data to develop categories related to the research subject in the context of the research to classify, summarize and tabulate the data. Articles available online have been included in this study using the search terms such as curriculum in mathematics education, evaluation in mathematics education, mathematics curriculum, and trends in mathematics education curriculum and evaluation on Google Scholar. Next, research articles and topics specifically related to the topic under study were examined. As regards the inclusion criteria set for this study, the articles relating to curriculum and evaluation in mathematics education published online between 2007 and 2023 have been included in the study. This study also included the studies with both quantitative and qualitative research designs. The context of this study was Nigeria and any other country where research was done on curriculum and evaluation in mathematics education. After searching for the studies and specifying the ones to be analyzed in line with the inclusion criteria, thirty studies were included and a coding protocol was designed based on the one utilized by (Dündar & Merç, 2017) consisting of the sample types and size, research method, data collection tools and data analysis techniques.

Results and Discussion

Table 1 showed the distribution of the studies based on the context where they had been conducted. 11 different contexts were identified and the frequencies are presented. It was revealed that half of the studies analyzed were conducted in Nigeria (50%), followed by Finland and USA (10%), then Cyprus (6.7%) and Thailand, Sweden, Cameroon, Netherland, Venezuela, Korea and Rwanda (3.3%). Thus, based on the articles analyzed, the frequencies of the studies on curriculum and evaluation in mathematics education outnumbered the ones in other contexts. A reason may be as a result of the consistent reform in mathematics education curriculum in Nigeria.

Table 1: **The distribution of studies based on their contexts**

Context	**F**	**%**
Nigeria	15	50
Thailand	1	3.3
Finland	3	10
Sweden	1	3.3
USA	3	10
Cameroon	1	3.3
Netherland	1	3.3
Venezuela	1	3.3
Cyprus	2	6.7
Korea	1	3.3
Rwanda	1	3.3
TOTAL	30	100

Frequency of the Studies based on their Publication Date

The results of the analysis in Table 2 showed that the studies analyzed were published between 2007 and 2023. The studies published in 2012 (13.3%) were more common. Followed by publications in 2007, 2014, 2017, 2018 and 2021 (10%). Then, followed by publications in 2016, 2019, 2022, and 2023 (6.7%) while the number of articles published on curriculum and evaluation in mathematics education was low in the year 2008, 2013, and 2015 (3.3%) while there was no publications in the year 2009, 2010 and 2011.

Table 2: Distribution of the studies based on the publication date

Publication Date	F	%
2007	3	10
2008	1	3.3
2012	4	13.3
2013	1	3.3
2014	3	10
2015	1	3.3
2016	2	6.7
2017	3	10
2018	3	10
2019	2	6.7
2021	3	10
2022	2	6.7
2023	2	6.7
TOTAL	30	100

Frequency of the Sample Types

In Table 3, the sample types used in the studies are presented. Based on the results from the quantitative studies, the researchers mainly investigated the views of teachers about mathematics education curriculum they were applying in Nigeria (67%) and in other contexts (56%). Table 3 also revealed that fewer studies were conducted with students compared to the ones with teachers both in other contexts (44%) and in Nigeria (22%). While only one study in Nigeria involved administrators (11%) with none in other contexts. None of the analyzed studies in Nigeria and other contexts involved the other stakeholders affected by the curriculum. Thus, as part of the system, other stakeholders such as the parents, policy makers, and publishers among others should be more involved in giving their views about curriculum and evaluation processes in mathematics education. Teachers who are indispensable implementers of the curriculum in the actual classroom environment can be easily reached, as well as the students unlike other stakeholders in curriculum development and evaluation processes, this may suggest the reason why many researchers neglect other stakeholders that may not be easily reached, thereby involving majorly teachers and students as convenient samples in their studies.

Table 3: Distribution of the Sample Type

Sample Type	Nigeria		Others	
	F	%	F	%

Teachers	6	67	5	56
Administrators	1	11	0	0
Parents	0	0	0	0
Policy makers	0	0	0	0
Publishers	0	0	0	0
Inspectors	0	0	0	0
Supervisors	0	0	0	0
Program facilitators	0	0	0	0
Program Directors	0	0	0	0
Officials	0	0	0	0
Coordinators	0	0	0	0
Students	2	22	4	44
TOTAL	9	100	9	100

Frequency of Sample Size

The distribution of sample size is presented in Table 4. Among the studies with a sample group according to Table 4, 13% of them have a sample size from 1-50, 10% each of them has between 51-100,101-150, 151-200, and 201-250, 7% of them have between 251-300, 23% of them have between 350-400, 7% of them have between 451-500, and 10% of them have a sample size of more than 500. It was observed from the study that majority of the studies (90%) utilized manageable sample size of less than or equal to 200 respondents who they can easily reach to obtain their views and share their opinions about curriculum and evaluation processes in mathematics education.

Table 4: Frequency of Sample Size

Sample size	Frequency	%
1-50	4	13
51-100	3	10
101-150	3	10
151-200	3	10
201-250	3	10
251-300	2	7
301-350	0	0
351-400	7	23
401-450	0	0
451-500	2	7
Above 500	3	10
TOTAL	30	100

Frequencies of Research Methods

Table 5 showed the frequencies of the research methods used in the studies. The table revealed that 57% of the studies employed qualitative research methods, 33% employed quantitative methods and 10% of the studies employed mixed methods. Compared to other methods, there were more studies with a qualitative research design as it focuses on words rather than numbers, depth rather than breadth and its methods is exploratory seeking to unearth the opinions, thoughts and feelings of respondents. More so, qualitative approaches were employed to achieve deeper insights into issues related to designing, developing and evaluating mathematics curriculum (Rahman, 2017; Ajao & Awofala 2022).

Table 5: Frequencies of Research Methods

Category	F	%
Qualitative	17	57
Quantitative	10	33
Mixed	3	10
TOTAL	30	100

Frequencies of Data Collection Tools

Table 6 summarized the frequencies of the data collection tools. The analysis showed that there is a dominance of qualitative data collection tools such as: documents (47%), observation (10%) and interviews (7%). The documents majorly utilized were textbooks and curriculum documents. Observations (10%) were used to check the curriculum implementation strategies in the classrooms while interview was used to get the teachers' direct views about mathematics curriculum. Among the quantitative data collection tools, questionnaire (23%) was mostly preferred by the researchers. The reason for this might be to determine the teachers' reception and perception about the curriculum changes in mathematics education and the relevance of the programme to mathematics teaching, while tests (13%) were used to evaluate or assess the effects of mathematics curriculum on students' achievements.

Table 6: Frequencies of Data Collection Tools

Category	F	%
Questionnaires	7	23
Test	4	13
Interview	2	7
Observation	3	10
Documents	14	47
TOTAL	30	100

Frequencies of Data Analysis Techniques

Table 7 presented the data analysis techniques applied in the studies. It is observed that quantitative analysis with descriptive (24%) and inferential (29%) tests, and qualitative analysis techniques

(47%) have been used in the studies. The most frequently used qualitative analysis type is the descriptive analysis (29%) followed by content analysis (18%). The reason for this might be to analyse, and describe the concepts and historical aspects of the curriculum development and evaluation in mathematics. The studies also utilized quantitative descriptive statistics type with frequency/ percentage (11%) topping the list, followed by mean/standard deviation (7%) and graphs (2%) was the least. 4% of the studies did not specify the particular type of the descriptive statistics used. As regards the inferential statistical tests, t-test (11%), ANOVA (7%), correlation and factor analysis (2%) were utilized as parametric tests in the studies, while Mann Whitney U (4%) and Chi-square (2%) were utilized as the non-parametric tests.

Table 7: Frequencies of Data Analysis Techniques

Category	**Sub-category**		**F**	**%**
Quantitative	Descriptive	Frequency/Percentage	5	11
		Mean/Standard deviation	3	7
		Graphs	1	2
		Not stated	2	4
TOTAL			11	24
	Inferential	Correlation	1	2
		t-test	5	11
		Factor Analysis	1	2
		ANOVA	3	7
		Mann Whitney U	2	4
		Chi-square	1	2
TOTAL			13	29
Qualitative	Content analysis		8	18
	Descriptive analysis		13	29
TOTAL			21	47
GENERAL TOTAL			45	100

General pattern of the findings of the studies on Evaluation and Curriculum in Mathematics Education.

Content analysis of the findings of the studies showed that there were common issues that the studies unveiled regardless of the context and publication date. The common findings can be classified under the themes of teacher, content and material related issues.

Teacher related issues: It was found that teachers perceived that teaching practices were not fully consistent with their actual practices and that they were not usually involved in curriculum reviews and development processes (Ampadu, 2014; Awofala, 2017). Thus, Awofala (2012, 2017) suggested more involvement of teachers at every stage of curriculum review/development, and that more qualified teachers should be recruited to improve the implementation of mathematics education curriculum.

Content related issues: It was unveiled that some concepts in the mathematics education curriculum are difficult as perceived by both teachers and students. Content of mathematics education curriculum was partially appropriate for students' level, that is, above the level of students; and that the contents lacked observing and creative activities thereby causing students' lack of understanding of mathematics education concepts. There is therefore a need to provide concrete examples and more engaging activities that will link the curriculum content with everyday life for easy understanding.

Material related issue: It was unveiled that the textbooks were relevant to the mathematics education curriculum and had positive effect on students' achievements in the subject (Koedel, Li, Polikoff, Hardaway & Wrabel, 2017).

Conclusion and Suggestions

Conclusion

This paper highlights the dynamic nature of research on evaluation and curriculum in mathematics education between 2007 and 2023 in Nigeria and other countries. The main conclusion drawn from the results obtained in the analysis are as follows; the studies on evaluation and curriculum in mathematics education conducted in Nigeria outnumbered the ones in other countries, majority of the studies focused on curriculum evaluation rather than development in mathematics. curriculum, the studies were more concerned with the views of mathematics education teachers and students. majority of the studies utilized manageable sample size which could be easily reached, the studies mainly employed qualitative research method compared to other research methods, documents and observations have been the major data collection tools in qualitative studies, questionnaires and tests were mostly utilized in quantitative researches while interview was minimal, quantitative and qualitative data analysis techniques have been used in the studies, descriptive and content analysis were dominant in studies which used qualitative analysis techniques, while frequency/percentage and mean/standard deviation, t-test and ANOVA were mostly utilized as descriptive and inferential quantitative analysis techniques respectively.

Suggestions for Future Research

Future studies should examine:

- the long-term effects of digital tools on student achievement and engagement in mathematics.
- developing professional development programs to equip educators with skills for implementing innovative evaluation practices.
- interdisciplinary and culturally responsive curricula.

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