



## Trends in Research in Curriculum Development and Evaluation in Mathematics

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### Abstract

This study explored trends in curriculum development and evaluation research in mathematics from 2000 to 2019. A meta-analysis of thirty (30) related studies was conducted, selected from journal articles available online, analyzed and coded through content analysis in terms of their contexts, sample type and size, data collection tools and data analysis techniques. The results showed; that curriculum evaluation studies were more prominent than curriculum development studies in mathematics; 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, while descriptive analysis was the most preferred data analysis technique in qualitative studies. Therefore, it is concluded that the study can serve as a foundation for further and enhanced study on these aspects in mathematics.

**Keywords:** Trends, Research, Curriculum Development, Curriculum Evaluation

### Introduction

A critical way to examine the big picture of a field and determine the tendencies of the studies in a specific field entails examining and presenting the results of the studies (Dundar & Merc, 2017; Eksioglu, Gur-Erdogan & Karabacak, 2014). This is only possible by organizing the findings and making critical reviews on the characteristics and findings of the studies on the same topic (Dundar & Merc, 2017). Eksioglu, Gur-Erdogan and Karabacak (2014) maintained that it is imperative to determine studies' direction in cultural structure, socio-economical situation and educational policies in the context of the country where the research is being done. Staton-spicer and Wulff (1984) as cited in Eksioglu, Gur-Erdogan and Karabacak (2014) stated that the best method of defining a study's field is by searching the research done in the context of the parameters of this field.

Curriculum development and evaluation are important issues that have gained the attention of researchers especially in mathematics as it is directly related to systematically presenting mathematics in order to ascertain smooth and improved teaching and learning in the subject. Given some defects found in school education, traceable to curriculum provisions needing corrections, Amadioha (2016) suggested curriculum development as a good means of introducing a change or an innovation into an educational system. Curriculum design and evaluation containing the approaches, methods, techniques and activities are regarded as part of the

development process (Dundar & Merc, 2017). In Nigeria, Amadioha (2016) opined that this curriculum development process follows a uniform mode except for some differences because as society changes, new problems, knowledge, values and needs arise which needed to reflect in the curriculum during the process of renewal. Thus, he maintained that curriculum development is dynamic in nature. It is therefore, necessary to examine critically the studies which have been done on curriculum development and evaluation in mathematics in order to get a clearer picture of the issue, the dynamism in the curriculum development process and to determine the general characteristics of the studies in a bid to summarise the common findings of the related studies. In this article, the meaning of curriculum, curriculum development and curriculum evaluation were unraveled, followed by the trend analysis of journal articles on curriculum development and evaluation in mathematics.

The meaning of curriculum varies based on different perspectives of people at different times and culture (Oloruntegbe, 2003). Generally, it is regarded as what the school teaches or a specific educational activity – subjects or subject matter. Thus, curriculum is synonymously referred to as: a syllabus, teaching units, a scheme of work, a course outline or subject matter of instructions such as Chemistry, Biology, Physics, Geography and Mathematics among others. It is also regarded as a means to an end or learning outcomes or a plan of what the school intends to do. From another point of view, it is the plan that guides the education's activity involving orderly, deliberate



and sustained efforts aimed at developing knowledge, concepts, skills, attitudes or habits. Consequently, curriculum is regarded as “a very foundation for any education system” (Igwe, 2011). From literature, it is defined as the totality of experiences offered under the guidance of the school (Igwe, 2011; Oloruntegbe, 2003). Its definitions could be categorized as narrow and broad. The narrow definition views curriculum as a **package** (something tangible to be taken away and used), that is, a detailed manual for the process of teaching and learning (Dundar & Merc, 2017). While the latter views it as a **process**, that is, the package and the continuous effort involved in bringing the package into being in terms of the thinking behind the package, and the continuous efforts of making it serve the needs of the society (Igwe, 2011, p.2).

The essence of exposing a learner to any educational program is to produce an observable change, obtainable only from a curriculum that is well planned and implemented (Oloruntegbe, 2003). Curriculum development is described as the process of planning learning opportunities that will result in certain changes and the assessment of the extent of such change (Nicholas and Nicholas, 1978 as cited in Igwe, 2011; Oloruntegbe, 2003). From another perspective, it is a complex process that involves making decision on issues that will culminate in the production of a curriculum plan (Aisiku, 1987 as cited in Igwe, 2011). It is a process focused on decision making on the kind of knowledge, skills and values to transmit, and how to arrive at the intended outcomes through the teaching and learning processes (Richards, 2001). Curriculum development is influenced by numerous factors such as, the learners, the changing nature of school, changes in society, development from the outside world, changes in educational thinking and changes in the nature of the subject (Igwe, 2011).

Curriculum development is incomplete without evaluation. After the design and the actual implementation of the designed curriculum, there is the need to determine whether the curriculum’s objectives are being achieved, whether the curriculum meets the expectations of the people it was designed for or whether a better curriculum design was achieved. To ascertain all these, there is the need for the evaluation of the totality of the curriculum design process (Dundar & Merc, 2017; Igwe, 2011). Aguokogbuo (2000) described evaluation as the process of determining the extent to which specified curriculum objectives are being achieved. He

expounded further that curriculum evaluation implies evaluating the various components of the curriculum which include: the objectives, content, learning experiences, the way in which the content and learning experiences are organised, methods of instruction, curriculum materials for curriculum implementation and the programme of evaluation itself (evaluation process) (p.79). Thus, the reason for conducting evaluation is to provide beneficial information that will aid decision making by curriculum planners. In other words, it collects and provides evidence for decision making about the feasibility, efficacy and educational value of the curricula. He stated that, though evaluation is the final step in curriculum planning and development process, yet it can be done at any stage of the curriculum development, because curriculum planning is (dynamic) constantly changing with the society, learner, conception of knowledge and the learning process. The many aspects that can be evaluated encompasses the curriculum’s needs as a whole or the learners’ needs, the sources, the system including curriculum, in-class implementation, the achievement and motivation of the learners, the school staff’s success including teachers and principals, and the conditions of the teaching-learning situation (Weir & Roberts, 1994 as cited in Dundar & Merc, 2017).

Regarding types of curriculum evaluation, there are two major types namely: formative and summative (Aguokogbuo, 2000; Igwe, 2011). Formative evaluation is undertaken at the developmental stage of the curriculum with the purpose of improving or modifying the curriculum during its planning, development and implementation. Summative evaluation on the other hand is done at the end of the process focusing on results and outcomes to determine the extent of the curriculum’s success and effectiveness (Dundar & Merc, 2017; Igwe, 2011) useful in revising the entire curriculum and/or revising some particular elements of the curriculum (Igwe, 2011).

### Research Questions

The main purpose of this study is to conduct a critical review of the studies on curriculum development and evaluation in mathematics 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 development and evaluation in mathematics 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 development and evaluation in mathematics?

### Method

This study conducted a meta-analysis through content analysis, a statistical technique involved in extracting and combining studies to produce a summary result (Haidich, 2010). The researcher used the process of categorizing verbal or behavioural data to develop categories related to the research subject in the context of the research to classify, summarize and tabulate the data (Dudovskiy, 2018). Articles available online have been included in this study using the search terms such as curriculum development in mathematics, curriculum evaluation in mathematics, mathematics curriculum, and trends in mathematics curriculum development and evaluation. 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 development and evaluation in mathematics published online between 2000 and 2019 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 development and evaluation in mathematics. After searching for the studies and specifying the ones to be analysed in line with the inclusion criteria, thirty studies were included and a coding protocol was designed based on the one utilized by Dundar and Merc (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 analysed were conducted in Nigeria (50%), followed by Turkey and USA (10%), then Australia (6.7%) and Tocoma, Sydney, Ghana, Newzealand, Vietnam, Japan and Ethiopia (3.3%). Thus, based on the

articles analysed, the frequencies of the studies on curriculum development and evaluation in mathematics outnumbered the ones in other contexts. A reason may be as a result of the consistent reform in mathematics curriculum in Nigeria.

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

Context	F	%
Nigeria	15	50
Tocoma	1	3.3
Turkey	3	10
Sydney	1	3.3
USA	3	10
Ghana	1	3.3
Newzealand	1	3.3
Vietnam	1	3.3
Australia	2	6.7
Japan	1	3.3
Ethiopia	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 analysed were published between 2003 and 2019. The studies published in 2012, 2014 and 2017 (13.3%) were more common. Followed by publications in 2008, 2013 and 2015 (10%). Then, followed by publications in 2016 and 2019 (6.7%) while the number of articles published on curriculum development and evaluation in mathematics was low in the year 2003, 2004, 2009, 2011 and 2018 (3.3%).

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

Publication Date	F	%
2003	1	3.3
2004	1	3.3
2008	3	10
2009	1	3.3
2011	1	3.3
2012	4	13.3
2013	3	10
2014	4	13.3
2015	3	10
2016	2	6.7
2017	4	13.3
2018	1	3.3
2019	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 curriculum they were applying in Nigeria (67%) and in other contexts (63%). Table 4 also revealed that fewer studies were conducted with students compared to the ones with teachers both in other contexts (37%) and in Nigeria (22%). While only one study in Nigeria involved administrators (11%) with none in other contexts. None of the analysed 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 development and evaluation processes in mathematics. 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	63
Students	2	22	3	37
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
TOTAL	9	100	8	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, 37% of them have a sample size from 0 to 50, 16% of them have between 51-100, 21% of them have between 151-200, 10% of them have between

401-450, and 16% of them have a sample size of more than 500. It was observed from the study that majority of the studies (74%) 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 development and evaluation processes in mathematics.

**Table 4: Frequency of Sample Size**

Sample Size	F	%
1-50	7	37
51-100	3	16
101-150	0	0
151-200	4	21
201-250	0	0
251-300	0	0
301-350	0	0
351-400	0	0
401-450	2	10
451-500	0	0
Above 500	3	16
TOTAL	19	100

### Frequencies of Research Methods

Table 5 showed the frequencies of the research methods used in the studies. The table revealed that 63% of the studies employed qualitative research methods, 33% employed quantitative methods and 4% 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 are exploratory seeking to unearth the opinions, thoughts and feelings of respondents (Tiley, 2017). More so, qualitative approaches were employed to achieve deeper insights into issues related to designing, developing and evaluating mathematics curriculum (Rahman, 2017).

**Table 5: Frequencies of Research Methods**

Category	F	%
Quantitative	10	33
Qualitative	19	63
Mixed	1	4
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 (58%), observation (6%) and interviews (3%). The reason may be because more

than half of the studies (63%) have qualitative research designs. It should also be pointed out that in some of the studies observed, more than one data collection tool was used. The documents majorly utilized were textbooks and curriculum documents. Observations (6%) 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 (24%) 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 and the relevance of the programme to mathematics teaching, while tests (9%) were used to evaluate or assess the effects of mathematics curriculum on students' achievements.

**Table 6: Frequencies of Data Collection Tools**

Category	F	%
Questionnaire	8	24
Test	3	9
Interview	1	3
Observation	2	6
Documents	19	58
TOTAL	33	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	%	
Qualitative	Descriptive	Frequency/percentage	5	11
		Mean/standard deviation	3	7
		Graphs	1	2
		Not stated	2	4
		TOTAL	11	24
Qualitative	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 Curriculum Development and Evaluation in Mathematics**

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 (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 curriculum at all levels of education.

**Content related issues:** It was unveiled that some topics in the senior secondary curriculum are difficult as perceived by both teachers and students. Content of mathematics 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 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 (Azuka, Jekayinfa, Durojaiye & Okwuoza, 2013; Cevik & Abidoglu, 2016; Tuge, 2008).

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

### Conclusions and Suggestions

This present study specified the trend of research on curriculum development and evaluation in mathematics between 2000-2019 in Nigeria and other countries. The main conclusions drawn from the results obtained in the analysis are as follows:

- The studies on curriculum development and evaluation in mathematics conducted in Nigeria outnumbered the ones in other countries.
- Majority of the studies focused on curriculum evaluation rather than curriculum development in mathematics.
- The studies were more concerned with the views of mathematics 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.
- The studies presented common findings regardless of their context and publication date.

In the light of the above findings, the following suggestions are offered:

1. More curriculum development studies should be carried out regardless of the context.
2. Aside from teachers and students' views, other stakeholders' opinions and experiences on curriculum development and evaluation in mathematics should be researched.

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