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JECAN, the official journal of Early Childhood Association of Nigeria (ECAN), presents its Volume 8 (2019). Membership of the association is open to students, graduates, practitioners and scholars of early childhood education and/or related fields in Nigeria and abroad.

All the articles that feature in this volume are those presented at the 2018 National Conference of the association held between 23 and 27 July, 2018 at FCT College of Education, Zuba, Abuja. Arrangements are on to make it possible for interested researchers to submit articles directly for publication in the journal.

It is therefore, the expectation of the Editorial Board that readers will not only find this volume a good companion in their continuous search for knowledge but also a reliable source of literature for further research activities.

Prof. Olusegun Akinbote
Editor-in-Chief

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CHILDHOOD EDUCATION TEACHER TRAINING AND TEACHING OF SCIENCE AND MATHEMATICS: IMPLICATIONS FOR NIGERIAN TEACHER EDUCATION

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Abstract

The National Policy on Education recommended that teachers be trained in Early Childhood and Primary Education (Childhood Education) to ensure that pupils are handled by the specialists in the field. The expectation here is that every teacher who is specially trained for this purpose should be able to teach all subjects successfully. Can this be totally realised if the teachers' competence in teaching of Science and Mathematics is to be measured? Can we boldly say the trainee teachers do receive a substantive content knowledge of the subjects with their pedagogical knowledge which is the dominant feature of most of ECE and primary curriculum the authors reviewed? Is taking the courses as minors/teaching subjects sufficient to train teachers in Science and Mathematics needed to lay a solid foundation for science and technology at elementary level? Are curriculums of teacher education in ECE and primary education rich in Science and Mathematics content? Answers to these pertinent questions all have implications for teacher education. Therefore, this paper highlights the role of Teacher Education (TE), discusses the importance of teaching Science and Mathematics in childhood education and the competence of teachers of these subjects. It also identifies some problems related to the training of childhood teachers and the teaching of Science and Mathematics and offers suggestions on how teacher preparation for early childhood and primary education can be improved for effective teaching and learning of Science and Mathematics at early years and basic education.

Keywords: Childhood Teachers' Training, Teaching of Science and Mathematics, Teacher Education, Teachers' Competences

Introduction

It is universally agreed that childhood education is the basis for lifelong education and sustainable development. It is, therefore, the ultimate goal of childhood education to provide children with holistic education that develops the whole child and promotes their well-being. Fortunately, the Federal Government of Nigeria (2012, 2014) in National Policy on Education (NPE) ultimately recognises this level of education and describes primary education as the key to success of the whole system. In the nation's effort to secure a quality crop of teachers for this level of education, the NPE recommended that teachers for early childhood and primary education should be specially trained. As a result, there was an increase in the number of institutions that offer this programme at federal, state and private universities and colleges of education. Presently, in Nigeria, we have 90 colleges of education (22 Federal, 47 State and 21 private) (NCCE, 2019). Out of 158 universities (40 Federal, 44 State and 74 private) approved by the National Universities Commission (NUC, 2018), only 17 universities offer the programme under similar nomenclatures such as Early Childhood and Primary Education, Nursery and Primary School Education, Primary Education, Pre-Primary and Primary Education, or Elementary Education (University Compass, 2018; Nigerian Scholar, 2019).

In the global education community, Teacher Education (TE) fulfils vital roles. TE, according to Ogunyinka, Okeke and Adedoyin (2015), refers to professional education of teachers towards attainment of attitudes, skills and knowledge considered desirable so as to make them efficient and effective in their work. The policies and procedures that are used to equip prospective teachers with the knowledge and competence they need to perform their tasks effectively in the field are formulated by TE. As further identified by Okemakinde, Adewuyi and Alabi (2013), TE includes training and or education occurring before commencement of service (pre-service) and during service (in-service or on-the-job). The fundamental role of TE is also clearly stipulated by NPE as providing teachers with the intellectual and professional background for their assignment (NPE (2004, 2012, & 2014; Ogunyinka, Okeke & Adedoyin, 2015).

It is understandable from all these assertions that Teacher Education is an integral part of any educational system. No wonder

UNESCO (2005) highlighted the responsibility of teachers' education institutions(early childhood care, pre-primary and primary education departments inclusive) as educating new teachers; provision of professional development opportunities for practicing in-service teachers aimed at updating their knowledge and skills; creating a teacher education curricular; carrying out research; contribution to textbooks; provision of expert advice to local schools when required; offering expert opinion to state and national ministries of education and educating and certifying headmasters, principals and other school administrative staff. Thus, TE is seen as a continuous process, starting from initial training and continuing throughout teachers' professional life through regular and sustained periods of in-service training.

More than other levels of education, teacher preparation for the level of childhood education should be the concern of educational planners and administrators because at this level, foundation for later and lifelong education is laid. The experience children have at this stage has enormous potential to determine the quality of their future education (Adedigba and Agarry, 2013). The teacher training of soon-to-be teachers of early childhood and primary education is expected to be able to equip them to offer pupils an all-round development and lay good background for subsequent learning. Generally, such training should include improving the general educational background of the trainee teachers; increasing their knowledge and understanding of the subjects they are to teach; pedagogy and understanding of children and learning; and the development of practical skills and competences (Jekayinfa, 2002; Okolo, 2013). This clearly reveals that institutions of TE are expected to bring changes within educational systems and shape the knowledge and skills of future generations.

Childhood Education Programmes in Teacher Education Institutions

The nomenclature given to the teacher education programme of childhood education varies from institutions to institutions; but the aims and objectives remain the same with curriculum or benchmark clearly reflecting to a reasonable extent the same content and pedagogy. In some institutions, there are two different departments handling these related fields (Early Childhood and Care Education-ECCE and Primary

Education Departments. This is mostly obtainable in the colleges of education where students are trained for three years. In universities, some have it as Department (or Unit) of Early Childhood Education as in Universities of Ibadan, Lagos, Nnamidi Azikiwe, Jos, Tai Solarin University of Education and National Open University. In Universities of Ilorin, Abuja, Port Harcourt and Ignatius Ajuru University of Education, it was named Primary Education Studies. The case is different in Kwara State University where the two programmes are run as a course - Early Childhood and Primary Education. In Delta State, Olabisi Onabanjo and Ekiti State Universities, it is named Nursery and Primary Education and available as Elementary Education in University of Calabar, while Universities of Benue, Uyo and Usman Danfodiyo University have it as Pre-Primary and Primary Education (JAMB, 2018).

In these teacher training institutions, study lasts for four years for Unified Tertiary Matriculation Examination (UTME) students, while direct entry students spend three years. The degree awarded also varies depending on how the curriculum is designed. In some of these teacher training institutions, early childhood and primary education studies is taken as a double major (BEd.) whereas some have it as a combined bachelor degree (BA, BSc/BEd). In double major, a student is taken through the curriculum of both pre-primary (ECE) and primary education without having a teaching subject or minoring in another department. In the alternative, a combined bachelor degree programme, a student simultaneously takes courses in either ECE or primary education with a teaching subject from any of arts, sciences and social sciences. The expectation is that a graduate of early childhood, pre-primary education, primary or elementary education (childhood education) either double major or combined honours is able to provide care for children and teach all subjects, including Mathematics and Science at preschool and primary school level. This is confirmed by Steve (2014) who said that the teaching of Science and Maths is not an option for the early childhood educator but a must. The pertinent question to ask here is 'Does the childhood education training curriculum make sufficient provision for this expectation, particularly in the teaching of Science and Mathematics?'

Importance of Science and Mathematics in Childhood Education

The National Policy on Education clearly stipulates teaching of scientific and reflective as well as mathematical skills at these levels of education (NPE, 2012; 2014). A cursory look at the aims of teaching each of these subjects clearly reflects their importance. As regards science education, it aims to excite and enthuse children with a sense of awe and wonder at the natural world, give pupils enough evidence-based knowledge to be able to make informed personal judgments in order to live healthy, safe, comfortable and environmentally sustainable lives. Also, it seeks to develop pupils' understanding and experience of the scientific method, to understand its value and limits, and to enable them to apply the method to everyday life, etc (Susman, 2013; Hechter, 2013; Christine, Taiwo, & Saidu, 2015). Also, Mathematics teaching aims at preparing children to think and communicate quantitatively and use maths to solve problems, to provide them with a wide range of knowledge, skills and related activities that will help them to develop an understanding of the physical world and social interactions, to analyse and describe a wide range of experiences, make predictions and solve problems (Gunning & Masah, 2011; Irish International Teachers' Organisation, 2013).

The reason why emphasis is laid on the teaching of these subjects are not far-to-seek. Science and Mathematics are explanations for the naturally occurring phenomena we observe around us in our everyday life. They afford us the opportunity to understand the workings of our world. For example, science is expressed in daily living as breathing, growing, decomposition, reproduction, diseases and weather. So also Maths is evident in weather, time, measurements, and statistics and so on. Science and math are partly responsible for individual differences like the way we talk, walk, cook, arrange things, approach problems or the way we solve them, among other things which are made manifest in logical reasoning, problem solving and ability to think in abstract way (Gilbert, 2010; Australian Academy of Science, 2011; Susman, 2013).

Starting out early and on a strong foundation in the field of Science and Maths is an important feat to technological advancements and sustainability of any country (Katcha & Wushishi, 2015). It helps guide the children without bias or confusion to pick up careers most

appealing to them in the field. Some of the other importance of teaching Science and Maths include but are not limited to the provision of answers to various life questions varying from simple questions like why rain falls? Why people fall ill? Why food spoils? What is the shape of the earth? Also, to more complex ones like why do you see bright lighting flash before you hear the thundering sound? What is the speed of acceleration of the earth? Are there other universes? Some of these answers provide us with opinions on how to live our lives (Smith & Southerland, 2007; Australian Academy of Science, 2011; Susman, 2013).

Furthermore, science avails us survival skills without which our life expectancy will be greatly reduced (Utley,et.al. 2005; Hechter, 2013; Susman, 2013).The knowledge gained from Science and Maths can be applied to manipulate the environment, make it more conducive to live in. For instance, identifying germs as the cause of several diseases informed hygiene, drugs and other measures as preventive or therapeutic measures for certain diseases, thereby preserving human lives. It also creates awareness of our environment and its resources, especially as pertaining to conservation. Through this, sustainable development is encouraged because every action has consequence on our environment. An understanding of how our actions affect our environment in the short or long run is important for sustainable practices which are made possible through science. It empowers us and creates avenue for inventions through our imagination (Australian Academy of Science, 2011; Hechter, 2013; Susman, 2013).

Scientific and mathematical methods help children develop skills required to solve real life problems. It ensures the development of problem solving skills. It puts their innate curiosity and thinking capabilities into processes that help provide solutions to life issues. Clements and Conference Working Group (2004) submitted that an engaging and encouraging climate for children's early encounters with Science and Mathematics develop their confidence in their ability to understand and develop scientific and mathematical skills and technological advancement. As explained by Lowrie (2009), basic numeracy and mathematics concepts utilised in a preschool or elementary classroom set the foundation for learning more advanced mathematics concepts. High employability, sound morals and the

completion of education can be closely linked to scientific and mathematical competence/skill. Scientific and mathematical knowledge and, especially their application put power ultimately in the hands of countries most committed to it. Countries that strongly support science and Maths programmes are better off economically and have greater numbers of people creating new technologies than the others (Sife, Lwoga, & Sanga, 2007). Hence, at early years and elementary education, the teaching and learning of Science and Maths should be given more attention.

Problems Related to the Training of Childhood Teachers and the Teaching of Science and Mathematics

Despite the importance of Science and Maths in the development of a nation, several challenges continue to limit the effectiveness in the teaching and learning of these subjects which, of course, has been a great concern. Teaching of Science and Maths in Nigerian schools and their quality have been questioned over time by parents, the general public and even the government (Osuolale, 2014). Science and Mathematics teaching has been criticised because of poor performance of pupils. For example, Ogunmade's (2005) study showed that large numbers of students learn very little Science at school. Studies also showed that most pupils find learning of Science and Maths to be difficult and perceive Science and Mathematics as orthodox and problematic subjects (Schwartz & Schmit, 2007, Osuolale, 2014). These issues have been attributed to some of the problems discussed below.

Technological advancements trends and the rate at which it progresses possess a great challenge for the training of pre-service teachers in developing countries. Equipment for the teaching of Science and Maths in institutions are usually unavailable, inadequate, out of date or at times irrelevant to the subject matter (Katcha & Wushishi, 2015; Nwoke & Nwaneri, 2017). New technologies that are fast, more precise and user-friendly are emerging; however, the access to these technologies by institutions in developing countries are impaired due to the high cost of purchase and maintenance (Archibugi & Pietrobelli, 2003 and Sife, Lwoga & Sanga, 2007). The implication of this for the teaching of Science and Maths will be the teaching of alternatives to practical rather than hands on learning experiences.

The facilities available within the school environment are important to a successful learning experience (Maphoso & Malo, 2014). Electricity supply, for instance, is required for the use of instruments like the microscope, hot plates, pH meter, aquarium, microwave, incubators, refrigerator, weighing balance, batteries, etc. which are key to certain experiment. As rightly put by Agba (2015), inadequacies in the supply of the necessary facilities will negatively impact the competence of teachers in training.

The system adopted and the curriculum available in Nigerian institutions have not been able to bridge the gap between reality and the teaching and learning of Science and Maths concepts. The curriculum is often overloaded with unacquainted concepts and laws. The curriculum produces one sided teachers (Osuolale, 2014; Christine, et. al. 2015). Those in the educational fields have more of pedagogical training and less of content knowledge, while pure Science and Maths graduates have more of content knowledge and less of pedagogical knowledge. The more disturbing issues about this one sided training is the fact that each of the factions claim superiority over the other. This is further reflected in the way trainee teachers are handled especially when they have to borrow courses from other faculties and departments. See table 1 below:

Table 1: Analysis of Science and Mathematics Content in Available Curriculum of Childhood Education Teacher Training Institutions

S N	INSTITUTIONS	All courses available	Departmental Courses (ECE/Pry Based)	Science Related Courses			Math Related Courses		
				S	F	%	S	F	%
1.	University of Lagos-UNILAG (A)	73	33 (45.21%)	C	4	5.48	C	1	1.37
				R	-	-	R	-	-
				E	4	5.48	E	-	-
				TOTAL	8	10.96		1	1.37
2.	Tai Solarin University of Education- TASUED (B)	68	68 (100%)	C	12	17.65	C	5	7.35
				R	-	-	R	-	-
				E	-	-	E	-	-
				TOTAL	12	17.65		5	7.35
3.	Kwara State University- KWASU (C)	61	28 (45.9%)	C	5	8.2	C	2	3.28
				R	-	-	R	-	-
				E	-	-	E	-	-
				TOTAL	5	8.2		2	3.28
4.	University of Ilorin- UNILORIN (D)	263	29 (11.03%)	C	2	0.76	C	1	0.38
				R	1	0.38	R	-	-
				E	33	12.55	E	13	4.94
				TOTAL	36	13.69		14	5.32
5.	University of Ibadan- UI (E)	58	18 (31.03%)	C	IC	IC	C	IC	IC
				R	IC	IC	R	IC	IC
				E	IC	IC	E	IC	IC
				TOTAL	I	IC		I	IC
6.	National Open University- NOUN (F)	73	37 (50.68%)	C	9	12.33	C	2	2.74
				R	-	-	R	-	-
				E	1	1.37	E	-	-
				TOTAL	10	13.7		2	2.74

7.	Nnamdi Azikiwe- UNIZIK Continuing Education Programme (CEP) (G)	75	50 (71.43%)	C				C			
				R	7	9.33			5	6.67	
								R			
				E				E			
				TOTAL	7	9.33			5	6.67	
8.	Colleges of Education (H): Early Childhood Education	75	35 (46.67%)	C	4	5.33		C	6	8	
				R	-	-		R	-	-	
				E	1	1.33		E	-	-	
				TOTAL	5	6.66			6	8	
9.	Colleges of Education (H): Primary Education	75	45 (60%)	C	8	10.67		C	7	9.33	
				R	-	-		R	-	-	
				E	2	2.67		E	-	-	
				TOTAL	10	13.33			7	9.33	

* S: Status, F: Frequency, %: Percentage, C: Compulsory, R: Required, E: Elective, IC: Inconclusive

In institution A, the curriculum has a rigid scheme for her students as courses are preselected and allows for a very slim avenue for flexibility in the selection of courses. The courses are categorised into University wide courses, Faculty of Education compulsory courses, Principal teaching subjects (compulsory), Subsidiary teaching subjects (Electives). Out of the entire courses offered (73) in the institution, only 33 (45.21%) are ECE/Primary based, 8(10.96%) Science and 1(1.37%) Mathematics based/related.

Institution B has a total of 68 courses which are all ECE/Primary based courses. Specifically, 12 (17.65%) are Science based/related, while 5(7.35%) are Mathematics based/related. Her childhood teacher

trainees are exposed to preselected list of courses; hence, there is no specific status for the courses, as the teacher trainees are required to take all the courses.

Institution C has courses preselected for students with little or no avenue for the students to choose. The statuses of her courses are compulsory, prerequisite or concurrent courses. They offer a total of 61 courses in all, out of which 28 (45.9%) are ECE/Primary courses, 5 (8.2%) are Science, and 2 (3.28%) are Mathematics based/related.

Institution D has a total of 263 courses available for study to their trainee teachers and runs the programme as Primary Education Studies (PES). ECE/Primary based courses account for 11.03% (29) of the courses used for their teacher training. The courses are categorised into Compulsory, Required and Elective. 36 (13.69%) and 14 (5.32%) are Science and Mathematics based/related, respectively. Majority of the Science and Mathematics based/related courses are assigned the status electives. Out of the 151 minimum credit units required for graduation, only 32 credits (10-16 courses) are allocated for elective courses that allow students the flexibility to pick courses from their subject teaching area. However, there is no guarantee that they would select Science or Mathematics based courses as there are no restrictions on the type of courses/faculties to selected from.

Institution E is specific in her teacher trainee programme having specialisations in Sciences, Language, Humanities and Social Sciences. She has a total of 58 courses available during the course of study and these courses are categorised into general studies, faculty, departmental, teaching subject, methodology and elective courses. The curriculum for training is quite rigid. Firstly, the courses are preselected for the trainee and secondly, there exists areas of specialisation. The only observable area of flexibility but which has also been limited by area of specialisation structure is that of her teaching subjects. The trainee is allowed a range of 2-6 courses (depending on the course credit unit) per level, from his/her first to third year to select courses from Chemistry, Physics, Botany, Zoology or Mathematics. This made it impossible for the authors to state the proportion of the courses that are Science/Mathematics based as well as the distribution of these courses based on status (compulsory/required/elective). The trainee can decide to choose only Science/Mathematics or a mix of both during the course of

his/her studies. However, only 1 (1.72%) out of the other categories of courses available to be taken by the trainee was Science based while none was Mathematics based.

Institution F has a total of 73 courses for the ECE/Primary teacher training. Of these, 37 (50.68%) are ECE/Primary based, 10 (13.7) and 2 (2.74) are Science and Mathematics based/related, respectively. The courses for her trainee teachers are also preselected and allow for only a slim opportunity for flexibility.

In institution G, the authors of this paper were unable to access the curriculum used for her regular teacher education. The curriculum examined here is that of her Continuing Education Programme in ECE, which is assumed to be used as well by the regular programme, except that it is spread over a period of six years. The institution preselected the courses needed by the ECE trainee teachers for graduation. She makes available a total of 75 courses for the training of teachers and ECE core courses take 71.43% of it all. The courses are categorised into General courses, Core courses and Specialisation courses. The representation of Science and Mathematics based and/related courses as contained in her curriculum are 9.33 % and 6.67, respectively.

Institutions in category "H" are colleges of education where a unified curriculum is used across Nigeria. In such institutions, provisions are made to take ECE and Primary programmes separately. Trainees in the ECE programme offer a total of 75 courses preselected courses out of which 35 (46.67%) are the core ECE based courses. In all, only 6.66% and 8% of the courses are Science and Mathematics based/related, respectively. Trainees in the Primary Education programme offer a total of 75 preselected courses, 45 (60%) of which are Primary based. In all, 10 (13.33%) are Science based, while 7 (9.33%) are Mathematics based/related.

Majority of these universities restricted the students' Science and Mathematics contents of their curriculum to teaching and elective courses which are usually limited by the number of credit units allocated to this category of courses.

Added to the curriculum issue is the habit of migrating students that are on probation or at the verge of dropping to the Faculty of Education. The authors also observed that in universities where combined honours is obtainable and minoring of courses is allowed,

some students do go and minor on courses that are not taught or relevant in childhood classrooms, while few take courses from Science and Mathematics. In the long run, this results into shortage of qualified Science and Mathematics teachers in Nigerian childhood schools. As Kola (2012) noted, teachers of these subjects are often poorly trained.

Furthermore, the teacher-student ratio is still an unresolved problem that is related to the teaching and learning of Sciences and Mathematics in training institutions. The departments where students of Childhood Education do go to minor in these courses are most times very large. The populations of the trainee teachers exceed the recommended holding capacities of most institutions, which implies that the student lecturer ratio is disproportional. Such inadequacies prevent the trainees from receiving adequate supervision and assessment to measure their competence level (Schwartz *et al.*, 2012).

The administrative procedure and governance of institutions significantly affect the learning experiences of teachers in training. Irregular academic calendars, strikes, riots, impromptu programmes and events, delayed graduation, inefficient admission and registration processes, hurried lectures and examinations, missing results, transportation logistics among others distort the conditions under which teachers in training are taught and assessed. Challenging situations in most cases reduce teachers' level of competence.

Fear and misconceptions are some of the causes of the failure in Science subjects and Maths. This is confirmed by WAEC (2007), where among other factors, fear and misconceptions were identified as the reasons for students' poor performance in Science subjects and Maths. This problem can be minimised if at the childhood education level, strong foundations on knowledge of scientific and mathematical concept and their applicability are laid. This is the more reason why teachers at this level should be trained to have good knowledge of Science and Maths and also possess sound ability to use different strategies.

Teachers of Science and Mathematics are crucial factors that determine the quality and effective teaching and learning of the subjects. Many of the teachers are not professionally trained to teach these subjects successfully, while many trained to teach the subjects are not competent (Osuolale, 2014; Christie, Taiwo & Saidu, 2015). Some may have the knowledge of the subjects but lack the method, while some

refuse to develop themselves to move with the technology and upgrade themselves to meet up with the challenges (Sife, Lwoga & Sanga, 2007; Mapho & Mapho, 2014). Also, the attitude of many teachers to teaching is discouraging and this affects the learning outcome of pupils in the subjects.

Competency Required of a Science and Mathematics Teacher

In the context of this paper, the competence of the teachers is considered as the most significant factors to teaching and learning in the field of Science and Mathematics. Wall, Litjens and Taguma (2015) observed that quality is the most significant factor determining the degree and persistence of impact of ECE. As stated in the National Policy on Education, no education can rise above the quality of its teacher. The input and process will determine the output. In other words, the quality of teaching and learning is determined by how the teachers are processed. This is captured in the words of Maduewesi (2005) that quality is a multi-faceted issue which encompasses how learning is organised and managed, the learning content, learning level achieved, learning outcomes and the learning environment. The issue of teachers' competence in the teaching of Science and Maths should be given a serious attention as quality determines how far the aims and objectives of teaching these subjects will be achieved. Quality aims at building competences that will enable people fit in well wherever they find themselves. Teachers' competencies are displayed in their skills and knowledge that enable them to successfully maximise student learning.

The performance of learners is sometimes attributed to the competence of the teachers while the competence of teachers is also determined by their level of competence in teaching the subjects. There are several challenges of Teacher Education in Nigeria but probably the greatest among all which suffers from all other challenges is the issue of competence of the in-service and the quality assurance in the training of pre-service teachers. Gilbert (2010) recognizes three necessary characteristics of a competent science teacher which is also applicable to a mathematics teacher. These are: Subject matter knowledge, pedagogical knowledge and pedagogical content knowledge.

Subject Matter Knowledge

Teachers should have a secure knowledge and understanding of the curriculum and related to enable them to teach effectively across the age and ability range for which they are trained. Ofsted (2013) reported that teachers' lack of subject knowledge has not been able to handle imprecision in terms of technical explanation to spot and tackle errors or misconceptions which can all impede learning of Science and Maths. There is need for the teacher to be confident enough in their own knowledge of science and mathematical concepts to identify the appropriate ideas, determine the level and explore opportunities to introduce and apply science and mathematics. Utley, Moseley and Bryant (2005) submitted that a teacher is likely to be confident in his/her own abilities to teach Science or Maths when he/she has achieved success in mastery experience. Knowledge of the content of the subject will give the mastery of the subject matter. Teaching these concepts in childhood classrooms should be more than what the textbooks say. In reality, the content knowledge determines what the author of textbooks writes down. However, if a teacher does not have adequate knowledge of the content/nature of Science and Maths, it becomes difficult to breakdown the knowledge to the level of their learners, which brings about misconceptions and dread as a result of confusion.

Pedagogical Knowledge

Many a times, the high rate of Science and Mathematics failure are as a result of poor attention given to Science and Mathematics teaching and learning. This might be as a result of teachers' lack of understanding of how children develop and learn scientific methods and mathematics concept. It may also be somewhat difficult for teachers to identify strategies for teaching these essential subjects. It is important for teachers to focus learning on how to create amazing experiences that encourage discovery through play, asking questions, exploration and using creativity to solve simple problems. ECE and primary education teachers should be trained in the latest techniques, strategies and methodologies of teaching Science and Mathematics including the use of all types of aids materials and developed technology that will enable them to create well-organised and rich experiences that can help in

formation and learning of science methods and Maths concept. Constructivist theorists emphasised practical activity as a best strategy for learning in childhood. Teachers' should have good knowledge of many experiences that can help children to be self-motivated. Clifford (2008) also emphasised the importance of multisensory experiences for learning and use of resources for demonstrating of an idea along with explanation.

Content and Pedagogical Knowledge

The ability of a teacher to deliver the content knowledge of Science and Maths-based subjects in the pedagogically most efficient way will give learners a lasting learning experience, encourage them to pursue careers in the field and consequently favour economic advancement and sustainable development in Nigeria.

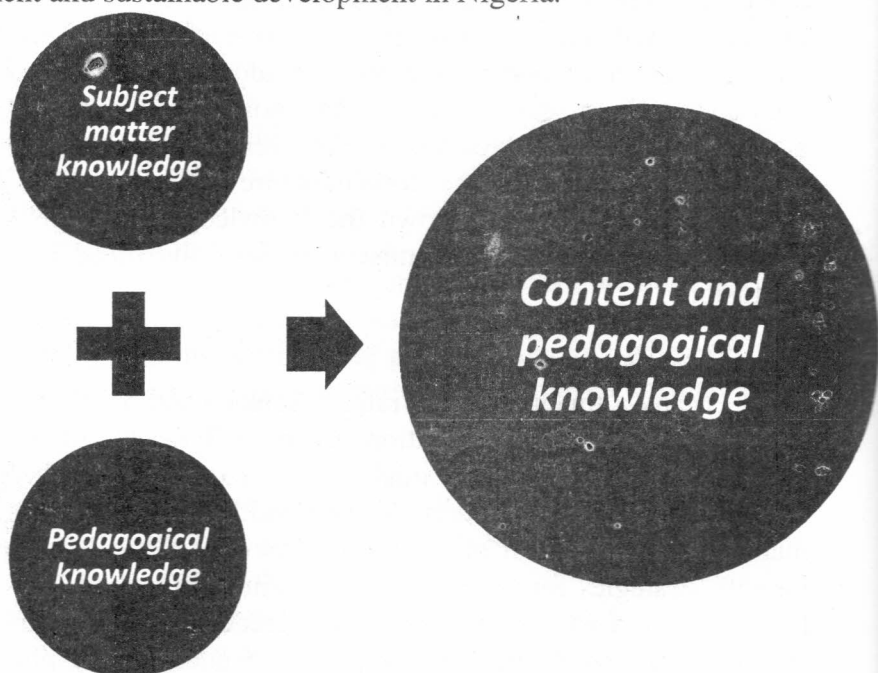


Figure: Competency required of a Science and Maths Teacher
Source: Adedigba and Olofintoye (2018)

Some teachers at childhood education level as a result of their training can teach Science and Maths effectively by drawing on either their general teaching skills or pedagogic knowledge but it is more when all is fused together to teach Science and Maths. It is discovered that pedagogical content knowledge brings together pedagogic and content knowledge to enable effective learning experience in Science and Maths. The role of subject matter knowledge and applying good pedagogy and pedagogical content knowledge can contribute significantly to effective teaching and learning of Science and Maths. Teachers should, therefore, be trained to develop their own conceptual understanding of Science and Mathematics and as well develop their general teaching skills and ability to utilise different strategies and methods.

Implications for Teacher Education

The proportion of Science and Mathematics contents of the curricula of the institutions analysed in this paper showed that in most of these institutions, childhood teachers in training are not sufficiently exposed to content knowledge required to ensure competence in the teaching of Science or Mathematics. Similarly, the content outline and description of some of these courses showed that the coverage areas are inadequate for the training of competent childhood education teachers expected to handle contemporary issues emerging in the field of Science and Mathematics.

Policy recommends that teachers at the ECE level of education should be trained to teach all subject areas in ECE and primary classrooms effectively. It is not an overstatement to submit that based on the curricula used for teacher trainees, the competency for this level of education is yet to be achieved as far as Science and Mathematics are concerned.

This then raises issues to be well-thought-out in the Teacher Education (TE) of ECE and Primary Education.

1. How can teacher trainee programmes produce competent teachers to teach Mathematics and Sciences in ECE and primary education classrooms?

2. Will the segregated curriculum especially at the universities offering these programmes not lead to differences in competence of teachers as transcript details are not demanded at the recruitment of teachers but only their certificates?
3. How feasible is the National Policy on Education's recommendation to train specialised teachers for ECE primary education?
4. Will competence not be much more attainable if teachers who are specially trained in Maths and Science education are encouraged to take diploma or postgraduate courses in childhood education (to enable them to acquire pedagogical competence in childhood education) and employed to teach at ECE and primary education level?

Conclusion

The importance of quality education in the childhood stages cannot be overstressed. Many problems schools, teachers and parents struggle with in children's subsequent education, particularly in the learning of Science and Maths would have been evaded if they are enabled to have solid background and are afforded quality experiences in the teaching and learning in the childhood classes. The training of teachers at childhood education holds a crucial standing in building of scientific and mathematics skills of children. Many other problems confronting teaching and learning of Science and Mathematics at these ages are identified in this paper but the one that serves as the pivot on which the wheel of Science and Mathematics rotate is the quality and competence of the teachers that teach these subjects. The quality and the competence of teachers in the teaching of Science and Maths is essential as quality teachers with the desired qualifications, competencies and abilities will be of immense assistance in the teaching and learning of Science and Maths. Quality assurance in pre-primary teacher preparation is, therefore, not negotiable as far as effective teaching and learning is concerned, especially in Science and math Education.

Recommendations

The preparation of the pre-primary and primary education teachers for effective teaching in schools should take cognisance of quality assurance and make competence of teachers a priority, particularly in the teaching of Science and Maths. The following suggestions are proffered:

- The curriculum of ECE and Primary Education programmes ineluctably need an exigent review. This is essential in order to achieve higher productivity as well as the supply of quality and competent teachers.
- To ensure effective Teacher Education programmes, science and mathematics content, knowledge of child development and pedagogy should be weaved together.
- Teacher education programmes should include attention to the Science and Mathematics module of early childhood programmes. The pre-service training and continuing professional development should provide opportunities for high-quality Science and Mathematics education trained in modern methods and techniques.
- Science teachers that are employed to teach in childhood schools should take a certificate course in ECE/Primary Education studies to equip them with method and strategies in childhood education.
- Special consideration should be given to graduates of colleges of education who seek direct entry admission to study any of childhood courses, especially those who studied Science and Mathematics and those who have their previous training in early childhood and primary education courses with their teaching subjects from these two courses.
- Candidates with good performance should be considered for admission into degree programmes. The departments of early childhood and primary education studies should not be made a dumping ground for weak students. The practice of absorbing students that are on probation or at the verge of dropping in other departments should also be frowned at.
- National Universities Commission should consider unified curriculum for childhood education teacher training at university as done in colleges of education.

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