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TEACHER EXPERIENCE AND COMPETENCES IN THE EFFECTIVE IMPLEMENTATION OF BASIC SCIENCE AND TECHNOLOGY CURRICULUM IN SCHOOLS

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Abstract

Many Nigerian basic education graduates enroll into senior secondary level of education standing on weak foundation for science learning. The Basic Science Curriculum (BSC) which they went through in the upper basic education is relatively new, and the teachers appear to be ineffective in the implementation of the curriculum. It therefore becomes important to find out the aspects of the required teaching competencies which BSC teachers lack for effective implementation of the Basic Science Curriculum of the junior secondary school. This will help to organize competency-based capacity development for BSC teachers who would be in position to give graduates of BSC strong foundation for science learning at senior secondary school level. Thus, this paper investigated the competency gaps of basic science teachers in implementing the basic science curriculum. The study adopted a descriptive survey. The study was carried out in Enugu state, Nigeria. The population of the study comprised 306 Basic Science teachers and 135 science teacher educators. The sample for the study consisted of 148 respondents. Two instruments namely Basic Science Teachers Competency Needs Questionnaire (BSTCNQ), and Basic Science Teachers' Competencies Observational Rating Scale (BSTCORS) were used for data collection. The BSTCORS had inter-rater reliability index of 0.97. The research question was answered using mean and standard deviation while the hypothesis was tested using t-test statistic at $p < 0.05$ level of significance. Results showed that all the competencies listed in BSTCNQ were assessed to be needed by BS teacher for the implementation of Basic Science Curriculum. It was also found that there was no significant difference in the mean rating scores of Basic Science teachers and science teacher-educators on competencies needed for implementing the Basic Science Curriculum. The educational implications of the findings of the study were highlighted and recommendations were proffered that stakeholders in basic education should provide funds appropriate human resources for organizing in-service training BS teachers to enhance their competencies and effectiveness in teaching of Basic Science.

Keywords: Teacher, Experience, Competences, Implementation of Basic Science and Technology Curriculum.

Introduction

The Universal Basic Education (UBE) programme, an educational reform programme of the Federal Government of Nigeria was introduced to enhance skills and knowledge development among Nigerian youths (Federal Government of Nigeria, FGN, 2000). The

main goal of the nine (9) year Basic Education (BE) as stipulated in the curriculum document is that every learner who has gone through the programme should have acquired appropriate levels of literacy, numeracy, manipulative, communicative and life skills as well as the ethical, moral and civic values required for laying a solid foundation for lifelong learning as a basis for scientific and reflective thinking, NERDC (2008). In line with the philosophy, the Nigerian Educational Research and Development Council ([NERDC], 2008) developed the nine (9) years Basic Education curricula for the primary and junior secondary school level of education. The old system, the 6:3:3:4 system of education was not properly implement and hence most of the objectives could not be achieved in the learner. Also. Nigeria offered free and compulsory primary education which was started in 1999 by the then president of Nigeria, Olusegun Obasanjo. This means that free and compulsory primary education was for only six years of formal education. Nigeria was desirous of increasing the number of years of free formal education in order to ensure that the desired level of skills and knowledge was achieved by the learners. Based on these national needs, the old primary school curriculum was reviewed and expanded to include three years of junior secondary school curriculum. Thus, Nigeria currently operates 9-year free basic education consisting of 6 years of primary and 3 years of junior secondary education. In sum, Nigeria's current education system is composed of 9 years of basic education, 3 years of senior secondary education and 4 years of tertiary education, (9, 3,4).

Among the science-related subjects approved for the 9 year basic education include: Basic Science, Basic Technology, Computer Education and Home Economics. These subjects indicate Nigeria's desire for rapid scientific and technological development of the country, since more citizens would be taught science and technology at basic education level, making them ready to become science and technology professionals at higher education levels. Before the emergence of the Basic Science of the junior secondary school, Integrated Science was taught at that level. The Basic Science which has replaced Integrated Science (by nomenclature) is broader and deeper than Integrated Science. This is because the needs of the learners have changed considerably over time, and the new Basic Science is designed to enable them acquire vital life skills for adapting and surviving in the society, as well as scientific knowledge necessary for more advanced science learning at senior secondary school level. From the curriculum document (Federal Ministry of Education FME, 2008), one deduces that the objectives of the new Basic Science curriculum include, but not limited to: development of learners' interest in science, application of basic scientific knowledge and skill to meet personal and societal needs taking advantage of the numerous career opportunities offered by the study of science, and preparation for further studies in science and technology.

In curriculum implementation or teaching and learning activities, the teacher is a critical factor because without him/her, progress in education would be minimal or absent completely. This is why the capacity of the teacher for effectiveness is of utmost important. (Etkina, 2010). Therefore, basic science teachers must exhibit a distinctive set of competencies to ensure the achievement of the goals of Basic Science Curriculum (BSC). Competency is the ability of an individual to perform a task effectively and efficiently. It is a set of defined behavior that provide a framework that enables the

identification, evaluation and development of the behavior in individuals (Ravan &Stephenson, 2001). Robinson (2010) sees competence as a combination of knowledge, skills and behavior needed to improve performance, or a state of quality of being adequate, or well qualified in having the ability to perform a specific role or task effectively and efficiently. Teacher competency refers to the ability of teachers to address the learning needs of all students including those students who learn differently because of individual peculiarities such as state of disability, culture, language or socio-economic status. In addition, Wassong and Biehler (2010) stated that teacher competency is characterized by teacher's knowledge of contents as well as developed pedagogical skills necessary for effective curriculum implementation. Etkina (2010) identified some basic science teachers' competencies to include teachers' level of demonstration of the willingness to examine and implement changes in Basic science as appropriate, and teachers' level of collaboration with colleagues, parents and community members in carrying out the job of teaching of Basic Science. The Basic Science teacher competencies are needed to give the teacher the expertise to perform efficiently in the classroom for enhanced students' achievement and interesting science.

The state of teaching of Basic science in the UBE programme seems discouraging. Odubum (2011) observed that Basic Science teachers do not seem to understand the philosophy of the Basic Science curriculum (BSC). In addition, Danmole (2011) reported that basic science teachers across Nigeria seem to demonstrate ignorance of the objectives of Basic science teaching, especially at the junior secondary school levels. Though the structure of Basic Science Curriculum in schools have been designed for inculcating essential knowledge, skills and attitudes for enhanced achievement and positive attitude in science related courses, the graduates of the programme do not seem to adequately possess the envisioned skills (Danmole, 2011).

In view of the deplorable state of the students' achievement in Basic Science (BS), the focus of this study is on the identification of competency gaps of Basic Science teachers for teaching of Basic Science in upper basic education schools. It is important to identify the competency gaps, which tend to make teachers underperform in their teaching responsibilities. The quest for effective teaching and students' high achievement begins with the question of the teachers possessing the necessary competencies. BS teachers' competency gaps have to do with what the teachers should know and be able to do while implementing the BSC but which they lack and therefore, become unable to effectively implement the BSC curriculum as planned. These gaps are weakness in the capacity of the BS teachers to successfully implement the subject matter contents prescribed the curriculum. Educational objectives cannot be achieved without determining whether the teachers have the necessary operational knowledge, skills and attributes for effective instructional delivery (Ahmed 2003). There is need to identify those areas in Basic Science Curriculum where teachers lack competence with a view to providing intervention strategies for bridging the gap and thus improve teaching and learning of basic science in secondary schools. This study is geared towards determining the competency gaps of basic science teachers in effective implementation of the Basic Science Curriculum. Competence gaps in teaching are the differences between the needed competences and possessed competences. Teacher's experience is one of the variables of the study, you need to discuss it in this introduction.

Teaching experience is the knowledge or skill gained through involvement in or exposure to teaching practice. As people progress in their profession or business, they acquire experience and develop skill to handle the challenge they encounter in their work. Therefore, it is expected that the competences possessed by teachers could increase and improve due to their years of experience. In termsof usefulness, the Princeton Research Association (2003) found out that more than 55% of teachers with 15 – 20 years teaching experience have greater competence in pedagogical, content knowledge than their counterparts with teaching experience below 15years. Jenning and Onwuegbuzie (2001) observed that older teachers find it more difficult to use innovative methods and technologies. Contrary to this, Nkwo (2003) found out that younger teachers with lower number of years of experience are more competent in teaching sciences than their older counterparts. Also, Onwuzuruike (2012) found out that English teachers with higher level of teaching experience find it difficult to use innovative instructional technologies in implementing the English curriculum than their younger counterparts. These assertions would be subjected to verification in this present study on competency gaps of basic science teachers. The above evidence indicates that teaching experience has inconsistent influences on effective delivery of curriculum contents the classroom level. Since the basic science curriculum is relatively new to the teachers and contains certain new topics have been added due to emergent ideas and problems in the society, it is certain how years of experience would influence teacher's competence. Such contents that have newly been infused into the basic science curriculum example computer appreciation, environmental education,and family and sexuality education etc) are likely to create competence gaps among basic science teachers. However, what remains uncertain is the direction teachers years of experience would influence the extent of competency gap that needs to be filled through capacity building in order to enable basic science teachers implement the curriculum. Hence, this paper will determine the influence of teachers' years of experience for implementing the new basic science curriculum

Research Questions

The following research question guided the study:

1. What are the competencies required of the Basic Science teachers for the implementation of Basic Science and Technology curriculum?

One null hypothesis was formulated to guide the study

Ho$_1$: Teachers' experience has no significant influence on the mean ratings of competencies possessed by Basic science and technology teachers for implementing the Basic Science curriculum.

Methodology

The design for the study is descriptive survey design. Descriptive survey is a research design that involves the collection of information from a representative sample of the population in order to describe the entire population. The population for the study comprised all 306 Basic Science teachers in all 278 public secondary school in Enugu state, the sample size is 128 Basic Science teachers.

Validation and Reliability of the Instruments

Five Science Educators validated the instrument (BSTCNQ) to ensure that all the competency items were the very important ones needed by the BS teachers. Cronbach's alpha internal consistency method was used to determine the reliability of the instrument. An internal consistency reliability of 0.97 was established for the instrument.

Data Analysis

The research question was answered using mean and standard deviation. A criterion mean of 2.50 was used as a benchmark for decision rule. Any item with a mean score that is equal to or above the criterion mean of 2.50 is considered to be accepted as competencies needed, or competencies possessed as the case may be. Any item that scores below this criterion mean is a competency that is not needed or not possessed. Hypotheses were tested using t-test statistics.

Results

Table 1: Mean and SD of the responses of the participants on the competencies required of the Basic Science teachers for the implementation of Basic Science and Technology curriculum

		YEARS OF TEACHING EXPERIENCE					
		0-5 $\overline{X}$ (SD)	6-10 $\overline{X}$ SD	11-15 $\overline{X}$ SD	16-20 $\overline{X}$ SD	21-25 $\overline{X}$ SD	26 and Above $\overline{X}$ SD
Content Knowledge							
1	Linking teaching objectives to lesson content	1.63 [.49]	1.49 [.58]	1.60 [.57]	1.33[[.49]	1.75 [.71]	1.38 [.52]
2	Linking lesson objectives to the assessment	1.58 [.51]	1.51 [.58]	1.64 [.57]	1.50 [.51]	1.75 [.71]	1.50 '[.53]
3	Providing appropriate learning resources to achieve lesson objectives	1.63 [.50]	1.53 [.58]	1.64 [.57]	1..33 [.48]	1.75 [.71]	1.50 [.53]
4	Planning the content of a lesson	1.63 [.68]	1.55 [.69]	1.68 [.63]	1.40 [.51]	1.75 [.71]	1.63 [.74]
5	The proper knowledge of the subject matter	1.68 [.67]	1.58 [.60]	1.72 [.61]	1.33 [.49]	1.75 [.71]	1.50 [.53]
6	Planning the summary of the lesson	1.84 [.69]	1.68 [.61]	1.76 [60]	1.60 [.74]	1.50 [.76]	1.50 [.76]
7	Engaging students in assessing their learning outcome	1.57 [.61]	1.68 [.51]	1.60 [.50]	1.73 [.70]	1.75 [.46]	1.50 [.53]
8	Using variety of instructional methods to address	1.52 [.61]	1.71 [.63]	1.56 [.58]	1.93 [.80]	1.75 [.71]	1.50 [.53]

	individual students' learning style during the learning process						
9	Engaging students actively during the lesson	1.52 [.61]	1 .71 [.57]	1.56 [.51]	1.87 [.83]	1.75 [.46]	1.63 [.52]
10	Presenting the lesson contents sequentially	1.74 [.73]	1.77 [.67]	1.64 [.64]	1.60 [.74]	1.25 [.46]	1.75 [.46]
	PEDAGOGICAL SKILLS						
11	Using variety of instructional strategies	1.79 [.71]	1.72 [.63]	1.60 [.57]	1.87 [.88]	1.62 [.52]	1.75 [.46]
12	Providing learners with appropriate practices	1.74 [.65]	1.68 [.67]	1.56 [.65]	1.80 [.67]	1.50 [.76]	1.50 [.53]
13	Using inquiry based instructional approach	2.10 [.66]	1. 75 [.70]	1.68 [.69]	1.73 [.70]	1.50 [.53]	1.87 [.64]
14	Using problem solving instructional approaches	1.68 [.75]	1.66 [.73]	1.60 [.71]	1. 80 [.67]	1.50 [.76]	1.00 [.00]
15	Providing examples of task to be completed	1.79 [.63]	1.60 [.53]	1.53 [.58]	1.60 [.58]	1.60 [.51]	1.50 [.53]
16	Offering slow learners extra instruction time	1.63 [.52]	1.52 [.69]	1.49 [.58]	1.52 [.59]	1.67 [.49]	1.50 [.53]
17	Monitoring learning and re-teaching when necessary	1.38 [.52]	1.68 [.58]	1.51 [.58]	1.56 [.58]	1.60 [.51]	1.63 [.52]
18	Using culturally appropriate materials(visuals, relia, oral and written texts) to teach basic science	1.42 [.50]	1.51 [.50]	1.52 [.50]	1.53 [.52]	1.50 [.53]	1.25 [.46]
19	Giving clear instructions and explanations	1.68 [.47]	1.52 [.50]	1.52 [.50]	1.60 [.51]	1.50 [.53]	1.50 [.53]
20	Ensuring the orderly progression of the lesson	1.53 [.51]	1.55 [.53]	1.68 [.62]	1.40 [.50]	1.62 [.74]	1.50 [53]
21	Planning suitable instructional objectives	1.79 [.41]	1.66 [.58]	1.80 [.65]	1.60 [.51]	1.75 [.71]	1.88 [.64]
22	Using set inductions	1.42 [.51]	1.58 [.60]	1.72 [.67]	1.40 [.51]	1.63 [.74]	1.75 [.71]
	CLASSROOM MANAGEMENT SKILLS						
23	Creating safe classroom environment	1.63 [.49]	1.64 [.62]	1.68 [.62]	1.60 [.51]	1.62 [.74]	1.75 [.51]
24	Ensuring appropriate seating arrangement in the classroom	1.42 [.61]	1.66 [.71]	1.68 [.69]	1.40 [.51]	1.75 [.71]	1.75 [.71]

25	Creating general class orderliness	1.68 [.58]	1.75 [.67]	1.80 [.64]	1.73 [.45]	1.75 [.71]	1.75 [.71]
26	Creating appropriate student teacher classroom interaction	1.63 [.59]	1.67 [.64]	1.72 [.61]	1.40 [.51]	1.62 [.52]	1.87 [.64]
27	Encouraging students to ask question	1.78 [.54]	1.73 [.62]	1.72 [.61]	1.60 [.50]	1.25 [.46]	1.75 [.71]
28	Being familiar with learner's learning styles	1.63 [.68]	1.50 [.54]	1.60 [.57]	1.40 [.50]	1.62 [.51]	1.75 [.71]
29	Minimizing distractions and interruptions	1.57 [.51]	1.52 [.50]	1.44 [.50]	1.66 [.48]	1.25 [.46]	1.62 [.51]
30	Treating all students equitably in the classroom	1.42 [.50]	1.47 [.50]	1.56 [.50]	1.40 [.50]	1.62 [.51]	1.50 [.53]
31	Creating a safe and stimulating classroom climate	1.47 [.51]	1.52 [.50]	1.48 [.50]	1.67 [.48]	1.37 [.51]	1.50 [.53]
	REESOURCEFUL						
32	Using improvised instructional materials in teaching Basic science	1.36 [.49]	1.47 [.50]	1.56 [.50]	1.33 [.48]	1.50 [.53]	1.37 [.51]
33	Constructing improvised instruction material	1.52 [.51]	1.64 [.48]	1.56 [.50]	1.86 [.50]	1.50 [.53]	1.50 [.53]
34	Using audio-visual devices for instructions	1.36 [.49]	1.49 [.50]	1.60 [.50]	1.46 [.51]	1.87 [.35]	1.37 [.51]
	ASSESSMENT/EVALUTION						
35	Using quiz assessment tools in evaluating students' learning outcome	1.57 [.50]	1.54 [.50]	1.52 [.50]	1.73 [.45]	1.37 [.51]	1.50 [.53]
36	Choosing/selecting assessment methods competencies needed	1.57 [.60]	1.54 [.53]	1.64 [.48]	1.73 [.70]	1.87 [.35]	1.50 [.53]
	Overall mean	1.61 [.10]	1.60 [.11]	1.62 [.10]	1.58 [.11]	1.59 [.11]	1.56 [.05]

Key: Number of the Respondents =128 basic science teachers

Data in table 1on competences possessed by teachers for implementing the basic science curriculum by years of teaching experience showed that basics sciences teachers with 0-5years had mean rating of 1.61, teachers with 6-10 years had mean rating of 1.60,basic science teachers with 11-15 years had mean rating of 1.62, basic science teachers with 16-20 years had mean rating of 1.58, basic science teachers with 21- 25 years had mean rating of 1.59 while their counterparts with 26 years teaching experience and above had mean rating different years of teaching experience do not possess the competences for implementing the new basic science curriculum.

Ho_1: Teaching experience has no significant influence in the mean rating of competences possessed by teachers for implementing the basic science curriculum.

Table 2:ANOVA on influence of Teaching Experience on Competencies possessed by teachers for Implementing the basic science curriculum.

Categorical variable	N	Mean $\bar{x}$	SD		Sum of squares	Df	F	Sig	Decision
0 -5yrs	26	1.61	.10	Between.	.028	4	.574	.682	NS
6 -10 yrs	50	1.61	.11	groups					
11 -15 yrs	35	1.62	.11	Within	1.239	123			
16 -20 yrs	12	1.59	.12	groups					
21 -25yrs	5	1.61	.13						
26 & above	0	0	0	Total	1.266	127			

There is no significant mean influence of teachers' years of experience on competencies possessed by teachers for implementing the basic science curriculum F (4, 207) = .574, p> .682 The null hypothesis was not rejected indicating that there was no significant influence of a teachers' years of experience on competences possessed by teachers for implementing the basic science curriculum.

Discussion

The findings of the study on teaching experience showed that teachers with difference years of teaching experience do not possess the competence for implementing the new basic science curriculum. The test of hypothesis showed that there was no significant influence of teacher's years of experience on competence possessed by teachers for implementing the basic science curriculum. Ideally, experience makes a difference especially at the beginning of a teacher's career. On average, teachers with some experience are more effective than brand new teachers; teachers improve the most early in their careers. The shift from no experience to some experience make the biggest difference in teaching profession. However, most teachers exhibited total lack of competence in teaching basic science, thereby making the finding of the study contradictory from what teaching should be in an ideal situation because teacher performance should vary at all level of experience. Individual teachers tend to improve with experience, but not all teachers begin their careers with the same skill or rise to the same level. Teachers with different years of teaching experience in this study never showed any improvement in their teaching expertise, meaning that they may have engaged in other extra activities in other to gain enough money to take care of their families since the stipends they receive at the end of each month cannot sustain the demands of their family making it difficult to learn the needed skills and knowledge for effective implementation, The result of this study could also be that teachers are not provided with the needed training they need to improve on their teaching profession through workshop and seminars the findings is in line with the findings of Onwuzuruike (2012), who found out that English teacher with higher level of teaching experience find

it difficult to use innovative instructional technology in implementing the English curriculum than their younger counterparts.

Conclusion

From the result of the study on competences possessed by teacher for implementing the new basic science curriculum, it showed that all the competencies outline in the work are needed for implementing the new basic science curriculum. The finding also showed that teachers do not possess the competencies needed for implementing the new Basic science curriculum. Basic science teachers with different years of teaching experience do not possess the competence for implementing new basic science curriculum.

Recommendations

Based on the findings the following recommendations were made

1 Government, stakeholders of education, curriculum planners should organize regular in-service training for teachers to get basic science teachers informed about the evolving knowledge to teach the new basic science curriculum.

2. Adequate fund should be provided for professional training Basic Science teachers.

3. Government should ensure that teaching and learning materials needed for teaching basic science curriculum are provided

4. Institutions, Colleges of Education and Universities should ensure that they equip Basic Science teachers adequately with the knowledge and skills needed for effective teaching and learning of BSC.

5. Teachers on their part should put more effort in teaching and learning of BS to internalize and perfectly understand the contents of the subject and its pedagogies.

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