BASIC SCIENCE TEACHERS' COMPETENCE GAP IN THE IMPLEMENTATION OF BASIC SCIENCE CURRICULUM IN EBONYI STATE, NIGERIA

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Abstract
The study examined the basic science teachers' competency gaps in the implementation of the basic science curriculum in Ebonyi State. Three research questions guided the study, which utilized a descriptive survey research design. The study population comprised 306 (142 male and 164 female) basic science teachers in all the 228 public junior secondary schools in the state, out of which a sample of 168 (76 male and 88 female) teachers were drawn for the study. Data were collected using the Basic Science Teachers' Competency Need and Possessed Questionnaire (BSTCN&(PQ) developed by the researchers. Overall reliability coefficients of 0.87 and 0.85 were obtained for sections B1 and B2 of the BSTCN&PQ respectively. The data gathered were analyzed using the mean and standard deviation. The study revealed, among others, that there are large competency gaps in basic science teachers' content knowledge, pedagogical and classroom management competencies, as well as resourcefulness and assessment/evaluation skills. It was therefore recommended, among others, that the government, through the federal and state ministries of education, should organize workshops for the training of in-service teachers of basic science on the various competencies required for effective implementation of the basic science curriculum.

Keywords: Basic Science, Competency gaps,implementation, Basic Science Curriculum

Introduction

Science is undeniably the backbone of technological and industrial developments. It is considered a systematic investigation aimed at discovering new knowledge and how to use such knowledge innovatively in solving individual and societal problems. Omoifo (2019) therefore asserted that the knowledge of science is no doubt very essential to human existence, as modern life requires general scientific literacy for every individual and society alike. Similarly, Ogunleye and Sowunm (2020) noted that advances in science and technology have indeed revolutionized human lives and ways of living. This may have resulted in the clamor for the need to promote the teaching and learning of science globally, of which Nigeria is no exception. The Federal Republic of Nigeria (FRN, 2013) recognizes the importance of the knowledge of science through the inclusion of basic science at the basic education level and various science subjects at the senior secondary school level, as well as science-based courses at the tertiary level of education.

Basic science, earlier known as integrated science, is a subject taught at the primary and junior secondary school levels to provide opportunities for the foundational exposure of learners to scientific knowledge and skills. The subject provides necessary preparatory knowledge for the study of the sciences (Odili, Ebisine, & Ajuar, 2011). According to the Federal Republic of Nigeria (FRN, 2013), basic science is an integrated subject (comprising biology, chemistry, and physics) presented to learners in such a way that they gain the fundamental unity of science and an understanding of the role and function of science in everyday life. This implies that basic science is an introductory subject that expose students to the rudiments of science that will enhance their future success in science subjects such as biology, chemistry, and physics. The desire of Nigeria to be identified with contemporary development worldwide again called for the infusion of relevant contents in the areas of Environmental Education (EE), Drug Abuse Education (DAE), Population and Family Life Education (PFLE), and Sexually Transmitted Infections (STI), including HIV/AIDS, into the basic science curriculum (Ogunleye & Sowunm, 2020).

The basic science curriculum for Nigerian basic education is structured in such a way that, at the lower basic level (primary 1 to 6), the subject is taught as Basic Science and Technology, while at the upper basic level (JSS1 to 3), it is taught as Basic Science (FRN, 2013). The curriculum is organized in such a way that there is a systematic link between basic science and technology at the lower level and basic science at the upper basic education level, and so on (Ezedinma, 2016). This implies that what students learn at the lower level is systematically linked to what they will learn at the upper level in basic science and the core science subjects at the senior secondary school (SSS) level.

Thus, the importance of basic science to individuals and society cannot be overstated. The overall objectives of the basic science curriculum, as stated by the Federal Republic of Nigeria (2013), include enabling learners to: develop an interest in science and technology; acquire basic knowledge and skills in science and technology; apply scientific and technological knowledge and skills to meet societal needs and solve everyday life problems; take advantage of the numerous career opportunities offered by science and technology; and become prepared for further studies in science and technology. Thus, it provides rudimentary scientific skills required by individuals for survival, sustainable development, and societal transformation (Ogunjobi, 2016). The author added that the subject is designed to expose students to science skills, which can help them resolve day-to-day problems. It promotes the development of necessary capabilities and creative skills that will enable individuals to cope with the ever-changing technological world (Omoifo, 2019). This central position of basic science as the bedrock for science and technological developments justifies its inclusion in the Nigerian school curriculum.

It is imperative to note that, no matter how well-planned and organized a basic science curriculum is, little or no positive result can be achieved if there is no proper implementation. Metz and Bartley (2013) defined implementation as the process of executing a plan, idea, model, design, specification, standard, or policy for doing something. It is the process of putting a decision or plan into effect or action (Ugwuanyi & Chukwuemeka, 2013). Accordingly, basic science teachers are expected to implement the curriculum by adopting appropriate methods and strategies for teaching and learning basic science. The teacher is required to guide the learners in carrying out the expected learning activities. According to Okonkwo and Ozurumba (2009), within the classroom, the teacher is a facilitator or a helper who guides learners as a result of training and experience gathered in the profession. As a planner, the teacher is involved in developing learning objectives, designing the method for achieving the objectives, and deciding on the assessment practice that will help generate feedback for possible improvement. The process of teaching therefore demands a high level of teacher competency.

Teachers' competency therefore plays a critical role in the curriculum implementation process. Onyeneho (2013) defined teachers' competency as their ability to be functionally adequate in the performance of expected tasks. It is a set of teachers' abilities, knowledge, and beliefs that are used to create an effective learning process (Guerriro, 2016). With respect to the implementation of the basic science curriculum, teachers' competencies therefore involve the abilities and skills expected of teachers for effective implementation of the basic science curriculum.

It is therefore pertinent to say that every basic science teacher ought to possess the requisite competencies to enable the teacher to function optimally. Mthethwa-Kunene, Onwu, and de Villiers (2015) stated that there are three areas of competency for the teacher, which include mastery of the content taught, pedagogical knowledge, and understanding the difficulties that would potentially impact learners when studying the content. The European Commission (2017) stated that teachers need to possess certain competencies such as content knowledge competence, pedagogical competence, classroom management competence, resourcefulness, and assessment and evaluation skills. Onyilo and Shamo (2017) also asserted that before going into the teaching profession, teachers must have undergone sufficient training in order to acquire such competency. This implies that teachers are expected to acquire a great deal of the above-mentioned competencies in order to achieve the desired learning outcomes. With the infusion of new content into the basic science curriculum, one may wonder how many competencies are possessed by basic science teachers for effective implementation of the curriculum. This is because the possibility of competency gaps among the teachers is inevitable.

Competency gaps, as defined by Ezeudu and Utazi (2014), involve the difference between the competencies possessed and the competencies needed. Ezeudu and Utazi also explained that gaps could be considered a comparison of actual performance against expected performance. Thus, in this study, the competency gap refers to the difference between the abilities or capabilities needed by basic science teachers and those possessed by them for the implementation of the basic science curriculum. Nwachukwu (2017) observed that basic science teachers appear not to have adequate knowledge and

skills or the required competencies for teaching the subject. This can consequently lead to poor implementation of the Basic Science curriculum due to some competency gaps, which may result in poor achievement in the subject.

In line with the above, previous reports have shown that students' academic achievement in basic science has been relatively poor (Bukunola & Idowu, 2012). Omebe and Omiko (2015) also observed that the performance of students in the Junior Secondary School Certificate Examination (JSSCE) in basic science was not encouraging. Evidence of students' achievement in basic science in the Basic Education certificate examination in Ebonyi State from 2018 to 2020 has shown that the majority of the candidates who enrolled for the examination had less than a credit pass, which is poor and disturbing. This could be attributed to the competency level of teachers in the teaching of the subject (Osuolale, 2014). The question then is whether there are competency gaps among basic science teachers in the implementation of the basic science curriculum or not.

Some available related studies have failed to clearly show the competency gaps in the implementation of the basic science curriculum. For instance, Offor (2016), who examined basic science teachers' competency in implementing the new basic science and technology (BST) curriculum, only reported that the teachers' competency level was low. Agbi (2017) found that integrated science teachers were moderately competent in planning and implementing instruction, evaluating instruction, and classroom management. Furthermore, Gongden and Gongden (2018), who conducted a study to assess basic science teachers' competencies in using simulations and games in schools, revealed that basic science teachers were not competent in content knowledge, pedagogy, or evaluation. In their study, Achor, Ejeh, and Odaudu (2018) submitted that teachers need training in order to equip them with pedagogical and classroom management competencies as well as relevant assessment skills and to make them resourceful. Similarly, Nwafor (2019) revealed poor content knowledge and pedagogical skills among basic science teachers. This situation seems to suggest that there may have been competency gaps among basic science teachers. However, there is a paucity of empirical literature to justify this claim. Hence, the problem of this study was to address this question: what are the basic science teachers' competency gaps in the implementation of the basic science curriculum in Ebonyi State?

Purpose of the Study

The general purpose of this study is to determine the basic science teachers' competencygap for the implementation of the basic science curriculum in Ebonyi State. Specifically the study determined the:

1. competencies needed by basic science teachers for the implementation of basic science curriculum;
2. competencies possessed by basic science teachers for the implementation of basic science curriculum;
3. competency gaps that basic science teachers need to fill in the teaching of the new basic science curriculum?

Research Questions

The following research questions were posed to guide the study:

1. What are the competencies needed by basic science teachers for implementation of basic science curriculum?
2. What are the competencies possessed by basic science teachers for implementation of the basic science curriculum?
3. What are the competencies gaps that basic science teachers need to fill in the implementation of the new basic science curriculum?

Method

The study utilized a descriptive survey research design. This is because the researchers were interested in collecting data on and describing in a systematic manner the competency gap of basic science teachers in the implementation of the basic science curriculum, which made the design more appropriate. The study was carried out in Ebonyi State, Nigeria. The study population comprised 306 (142 male and 164 female) basic science teachers in all the 228 public junior secondary schools in Ebonyi State. Out of the population, a multistage sampling procedure was used to draw a sample of 168 (76 male and 88 female) teachers for the study. The Basic Science Teachers' Competency Need and Possessed Questionnaire (BSTCN&PQ), developed by the researchers, were used for data collection. The BSTCN&PQ had two sections (A and B1 and B2). Section A elicited the demographic

information of respondents, while Sections B1 and B2 contained 54 items that elicited data on competencies needed and those possessed by basic science teachers' in the implementation of the basic science curriculum. In Section B1, the respondents provided their responses based on the modified Likert type scale that ranged from Highly Needed (HN), Needed (N), Moderately Needed (MN), and Not Needed (NN), with numerical values of 4, 3, 2, and 1, respectively. While the B2 section was used by the researchers and the research assistants in rating the respondents following a scale that ranged from Highly Possessed (HP), Possessed (P), Moderately Possessed (MP), and Not Possessed (NP), with numerical values of 4, 3, 2, and 1, respectively,

The instrument was subjected to face-to-face validation by three specialists: one each from Measurement and Evaluation, Biology Education, and Integrated Science Education. The validators were requested to scrutinize the items of the instrument in terms of relevance to the purpose of the study, adequacy, language clarity, and appropriateness to the problem under study. The specialists were also requested to make comments and suggestions with regards to how to improve the quality of the instruments. Their comments, corrections, and suggestions, such as modifications of the specific purposes, research questions, and hypotheses, as well as some of the items in terms of grammar and appropriateness, led to the final version of the instruments.

The reliability of the Basic Science Teachers' Competency Need and Possessed Questionnaire (BSTCN&PQ) was ascertained after trial-testing it on a sample of thirty (30) basic science teachers in public junior secondary schools in Onueke Education Zones of Ebonyi State, which was not sampled for the study. The reliability coefficients (r) for the BSTCN and PQ were obtained using Cronbach's alpha method for the instrument. Overall reliability coefficients of 0.87 and 0.85 were obtained for sections B1 and B2 of the instrument, which showed that it was good for the study. The instruments were administered to the respondents and retrieved immediately upon completion of the respondents' section. Thereafter, the researcher and the research assistants used the same instruments to rate the Basic Science teachers' competencies in the implementation of the Basic Science Curriculum, such as content knowledge competence, pedagogical competence, classroom management skills and competence, resourcefulness, and the teachers' assessment and evaluation skills. This was done during basic science lessons.

The collected data were sorted and coded in the IBM Statistical Package for the Social Sciences (SPSS) and analyzed using the mean and standard deviation. The interpretation of the mean for research question 1 will be based on the real limit of numbers as follows: highly needed (HN) = 3.50–4.00, needed (N) = 2.50–3.49, moderately needed (MN) = 1.49–2.49, and not needed (NN) = 1.00–1.49. For research question 2, the interpretation will be, Highly Possessed (HP) = 3.50-4.00, Possessed (P) = 2.50-3.49, Moderately Possessed (MP) = 1.49-2.49, and Not Possessed (NP) = 1.00-1.49.

Results

Research Question One (1): What are the competencies needed by basic science teachers for implementation of basic science curriculum?

Table 1: Mean and standard deviation on the competencies needed by basic science teachers for implementation of basic science curriculum(n=168)

S/N	Item Statements	Cluster Means	Standard Deviation	Decision
1.	Content knowledge competence.	3.47	.70	N
2.	Pedagogical competence	3.41	.79	N
3.	Classroom management competence.	3.51	.80	HN
4.	Resourcefulness	3.54	.69	HN
5.	Assessment/evaluation skills.	3.61	.81	HN
	Grand Mean	**3.51**	**.46**	**HN**

Note: n = Number of Respondents, N = Needed, HN = Highly Needed

The result in Table 1 shows that the mean responses for content knowledge competence and pedagogical competence were within the range 2.50–3.49, which implies that they are needed by basic science teachers in the implementation of the basic science curriculum. The mean ratings for classroom management competence, resourcefulness, and assessment and evaluation skills were within the range of 3.50–4.00, which shows that they are highly needed by basic science teachers in the implementation of the basic science curriculum. Furthermore, the grand mean value of 3.51 also falls within the above range for highly needed. This is indicative that content knowledge competence, pedagogical competence, classroom management competence, resourcefulness, and assessment and

evaluation skills are highly needed by basic science teachers in the implementation of the basic science curriculum.

Research Question Two (2): What are the competencies possessed by basic science teachers for implementation of the basic science curriculum?

Table 2: *Mean and standard deviation on the competencies possessed by basic science teachers for implementation of the basic science curriculum(n=168)*

S/N	Item Statements	Cluster Means	Standard Deviation	Decision
1.	Content knowledge competence.	2.14	.47	MP
2.	Pedagogical competence	2.23	.57	MP
3.	Classroom management competence.	2.13	.47	MP
4.	Resourcefulness	2.15	.65	MP
5.	Assessment/evaluation skills.	1.69	.49	MP
	Grand Mean	**2.09**	**.29**	**MP**

Note: n = Number of Respondents, MP = Moderately Possessed

The results in Table 2 indicate that the mean rating for all the competencies was within the range of 1.50-2.49, which shows the various competencies are moderately possessed by basic science teachers in the implementation of the basic science curriculum. The grand mean value of 2.09 also falls within the above range. This implies that basic science teachers moderately possess content knowledge competence, pedagogical competence, classroom management competence, resourcefulness, and assessment and evaluation skills.

Research Question Three (3): What are the competency gaps that basic science teachers need to fill in the implementation of the new basic science curriculum?

Table 3: Mean and Standard Deviation on the competencies gaps that basic science teachers need to fill in the implementation of the new basic science curriculum. N = 168

S/N	Item Statement	$\bar{X}_N$	$\bar{X}_p$	$\bar{X}_N - \bar{X}_p$	Rmk
1.	Content knowledge competence.	3.47	2.14	1.33	ECG
2.	Pedagogical competence	3.41	2.23	1.18	ECG
3.	Classroom management competence.	3.51	2.13	1.38	ECG
4.	Resourcefulness	3.54	2.15	1.39	ECG
5.	Assessment/evaluation skills.	3.61	1.69	1.92	ECG
	Grand Mean	**3.51**	**2.09**	**1.44**	**ECG**

Note:n = Number of Respondents,$\bar{X}_N$ = Competencies Needed, $\bar{X}_P$ = Competencies Possessed,

$\bar{X}_N - \bar{X}_p$= Competencies Gap, ECG = Existence of Competency Gap

The results in Table 3 show that the competency gap values ranged from 1.18 to 1.33 and were positive. This is an indication that there is a competency gap in content knowledge competence, pedagogical competence, classroom management competence, resourcefulness, and assessment and evaluation skills. The grand mean competency gap value of 1.44 showed that there are large competency gaps in basic science teachers' content knowledge, pedagogical and classroom management competencies, as well as resourcefulness and assessment and evaluation skills.

Discussions

The aim of this study was to examine the gaps in basic science teachers' competencies in the implementation of the basic science curriculum in Ebonyi State. The findings of the study showed that content knowledge competence, pedagogical competence, classroom management competence, resourcefulness, and assessment and evaluation skills are highly needed by basic science teachers in the implementation of the basic science curriculum. This finding is true because, with the infusion of some contents into the new basic science curriculum, the teachers may need some level of competency in the implementation of the new curriculum. This finding agrees with Nwachukwu (2017), who observed that basic science teachers appear not to have adequate knowledge and skills or the required

competencies for teaching the subject. In the same vein, the finding is consistent with that of Achor, Ejeh, and Odaudu (2018), who submitted that teachers need training in order to equip them with pedagogical and classroom management competencies as well as relevant assessment skills and to make them resourceful. This implies that the teachers needed some level of competency in teaching their subject area.

The findings of the study showed that basic science teachers moderately possessed content knowledge competence, pedagogical competence, classroom management competence, resourcefulness, and assessment and evaluation skills. This means that basic science teachers do not possess the maximum competencies for effective implementation of the basic science curriculum. This finding is consistent with the finding by Offor (2016), who examined basic science teachers' competency in implementing the new basic science and technology (BST) curriculum and reported that the teachers' competency level was low. The finding also lends support to the finding of Agbi (2017), which showed that integrated science teachers were moderately competent in planning and implementing instruction, evaluating instruction, and classroom management. This shows that basic science teachers still need a great deal of the abovementioned competencies in order to ensure effective implementation of the basic science curriculum.

Finally, the study revealed that there is a large competency gap in basic science teachers' content knowledge, pedagogical and classroom management competencies, as well as resourcefulness and assessment and evaluation skills. This finding adds credence to Ezeudu and Utazi's (2014) revelation that there were competency gaps among geography teachers that needed to be filled for effective teaching and learning in secondary school. In the same vein, the finding agrees to some extent with Gongden and Gongden (2018), whose study discovered that basic science teachers were not competent in content knowledge, pedagogy, or evaluation. Likewise, the finding lends support to Nwafor (2019), who revealed poor content knowledge and pedagogical skills among basic science teachers. These findings portray that basic science teachers have some competency gaps that need to be filled in order to ensure effective implementation of the basic science curriculum in Ebonyi State, Nigeria.

Conclusion

Based on the findings of this study, it is concluded that there is a moderate level of content knowledge competence, pedagogical competence, classroom management competence, resourcefulness, and assessment and evaluation skills among basic science teachers. This portrays considerable competency gaps among the teachers in the implementation of the basic science curriculum. Hence, if the competency gaps are not addressed, there is likely to be poor teaching and learning of the subject, which will likely result in poor student achievement in the subject.

Recommendations

Based on the findings, the researchers recommended that:

1. Basic science teachers should be encouraged to ensure proper self-development of the competencies needed for effective implementation of the basic science curriculum.
2. The government, through the federal and state ministries of education, should organize workshops for the training of in-service teachers of basic science on the various competencies required for effective implementation of the basic science curriculum.
3. Teachers' education programmes should ensure that basic science teachers are adequately equipped with the necessary competencies for effective implementation of the basic science curriculum.

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