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Factors Affecting Science Content Knowledge Delivery among Primary School Teachers in Nigeria

Ojekwu, Ifeoma Ngozichukwu

Ph.D. Student, Department of Science Education,
National Open University of Nigeria, Abuja, Nigeria

Abstract:

This study investigated the factors affecting Science Content Knowledge delivery among Primary School Teachers in Nigeria. Specifically, it identifies the sources of primary school teacher's science content knowledge which includes teacher preparation programmes, teaching experience, and teacher-students discourse. The study also identified the curriculum, pedagogy, lesson time as factors affecting Science Content Knowledge delivery among Primary School Teachers in Nigeria. The implications of this development are that teacher's self-efficacy will be greatly undermined which led to poor science content knowledge delivery to the pupils. Also, the pupil's achievement in sciences becomes adversely affected. The study suggested retraining programmes for the teachers to update their science knowledge.

Keywords: Content knowledge, Nigeria, primary school, science, teachers

1. Introduction

There is a sense of growing concern among education stakeholders about the science content knowledge of primary school teachers. Studies have shown a gap in the knowledge of science contents among primary school teachers across the world. Extant literature has shown that this situation poses a grave challenge to the teaching and learning of sciences at the basic education level. It affects the quality of science knowledge imparted to the pupils, with the attendant consequences on their future science studies among the pupils (Uyoata, 2006). This development has led to certain shortcomings in science teaching which engenders teacher-centered teaching approaches, and inhibits pupils' creativity and curiosity. Unarguably, when primary school teachers have inadequate science content knowledge, the resultant effect is poor teaching of the sciences and poor students' performance in the sciences.

In order to ensure effective science teaching, it is the responsibility of the teacher to create a learning environment that is conducive to learn, and which also challenges the pupils to develop deeper understanding of scientific concepts. This condition will facilitate the pupil's use of higher mental and perceptual faculties in exploring and understanding the world through the prism of sciences (Aina, 2007). Effective science teaching ensures that pupil's interest and prior experiences are taken into considerations during science lessons by the teacher, and this effectively enhances the student's performances in science. Therefore, in order to achieve this objective, there is a need to look at the science content knowledge of primary school teachers.

It is very critical to primary school teachers possess and develop adequate and comprehensive science content knowledge in order to teach effectively and efficiently (Omoifo, 2012). One of the underlying principles in instruction is that the teacher is ought to know more than the learner. It is presupposed that the teacher must possess and exhibit superior mastery and knowledge of science content in order to transfer learning to the pupils. A deviation from this will result in haphazard and meaningless instructional activities. Science teaching requires a deeper understanding of science, the underlying principles and attendant application of such knowledge. Primary school teachers who teaches science should be able to effectively relate this with their immediate environment and time, in order to convey meaning and understanding to the pupils. In the teaching of sciences, science content knowledge is very critical for the transmission of knowledge from the teacher to the pupils.

A deeper science content knowledge among the teachers will enable them to exhibit mastery over what they are teaching, and be able to accept challenges from the pupils, clarifying misunderstanding among the pupils and ensure authentic learning (Cochran-Smith & Lytle, 1999). Sufficient science content knowledge also enables the primary school teachers to plan their instructional process. From interpretation of the curriculum to the design of lesson plans, adequate knowledge of science subject's contents ensures that the teacher is an efficient facilitator of knowledge to the pupils. The essence of this is that learning involves a planned process where often its outcomes are measurable. When the teacher lacks adequate science content knowledge, it's often difficult to attribute pupil's performance to the knowledge delivered by the teacher to them in the classroom (Ishola & Udofia, 2017). Also, it becomes difficult for the evaluation of learning outcomes as against individual pupil's characteristics like learning difficulties.

Another important challenge that primary school teachers may face if they don't have adequate science content knowledge is that they will not be able to effectively assess the efficiency of their teaching strategy. This is because with

shallow content knowledge delivered to the pupils, the teacher cannot authoritatively argue on the effect of a teaching strategy on students' performance in the sciences.

2. Sources of Teachers' Science Content Knowledge

There are varied sources of knowledge available to the primary school teacher in teaching science to the pupils. These are discussed below:

2.1. Teacher Preparation Programs

Teachers' quality depends on their preparation within the professional development programmes. (Ejima, 2012). In Nigeria, primary school teachers undergo a three-year national certificate of education (NCE) program before becoming qualified to teach in a public primary school. This formal training equips student-teacher with the basic knowledge in the chosen subject area, along with general pedagogy. One of the characteristics of the preparation program is that it exposes the student-teacher with a wide range of subjects which often makes the primary school teacher a generalist, and not a subject specialist. The aim of such an approach is to enable the teacher to handle the subjects as he/she is expected to be in charge of the entire subjects in their class. During the teacher preparation program, while emphasis is laid on certain subjects of choice, the student-teacher is expected to also have a general knowledge of all the subjects.

2.2. Teaching Experience

Teachers accumulate significant amount of classroom experience over time in their profession. With time, these experiences may form a significant part of knowledge pool from which the teacher transmits ideas and knowledge to the pupils. Studies have shown that as time passes, teachers become more efficient and knowledge-resourced in their classroom instruction more than novice teachers (Nilsson & Loughran, 2012). Primary school teachers accumulate science knowledge over time as they carry on their instructional activities. While not linearly-related, literature has pointed out that teachers who stayed long in the teaching profession are able to display a higher level of mastery of subject content knowledge than newer teachers, indicating the accumulation of experience over time.

2.3. Teacher-Students Discourse

One of the undervalued sources of teacher's content knowledge is the discourse that takes place between teachers and pupils in an instructional setting. The classroom setting may become a fertile ground of ideas, and conceptions (Davis, 2003). During the course of the teaching-learning activities, the pupils may bring up ideas or knowledge that may be novel to the teacher, yet relevant to the issue being discussed. Though the classroom teacher is expected to exhibit a certain mastery of subject content knowledge towards the pupils, but that should not discountenance the fact that the contributions of the pupils are relevant (Mercer, Dawes, Wegerif, & Sams, 2004). The ideas questions, or doubts expressed by the pupils may evoke deeper thoughts in the teacher which eventually evolve into newer understanding of the issues discussed. With the ease that information and communication technology have made knowledge to be accessible, pupils may easily get hold of science information from their homes and peers which they will share in class.

2.4. Learning from Peers

Peer experience can prove to be a very good and reliable source of primary school teacher's science content knowledge. Primary school teachers can access knowledge from their colleagues (Carver, 2016). It can be upon request, or during causal interaction. Teaching peers have proved to be a reliable source of science content knowledge among primary school teachers as individuals seek clarifications, new knowledge or exploring of ideas with their colleagues. In a system where there is a high level of peer cooperation, content knowledge easily moves around from one teacher to another as they seek to assist each other (Fairman & Mackenzie, 2012). This source of science content knowledge depends to a great extent on a good peer relationship among the primary school teachers.

3. Factors Affecting Science Content Knowledge Delivery among Primary School Teachers

3.1. Level of Teacher's Science Content Knowledge

Teacher's level of science knowledge is a determining factor in science content knowledge delivery to their pupils. One challenge that primary school teachers have is to develop adequate, timely, and relevant science knowledge which will ensure that their instructional delivery of science knowledge to their pupils are effective (Harlen & Holyrod, 1997). With the growing demand for a society where science and technology is the language of progress and development, primary school teachers are even under greater pressure to develop this scientific orientation the pupils at that early stage of educational development when teachers are equipped with adequate and relevant science knowledge, their lessons becomes interesting, while the pupils becomes engaged. Studies have shown that teachers who are more knowledgeable in sciences content are more competent and show more professionalism in their instructional activities.

3.2. Availability and Utilization of Instructional Resources

Instructional resources enhance meaningful learning and leads to efficient and effective teaching activities. The availability and utilization of various instructional resources by primary school teachers is a prerequisite for the delivery of science content knowledge that doesn't look like mere story-telling to the pupils (Ofoegbu, 2012). At that stage in their educational development, the pupil's level of understanding accepts more of concrete knowledge than abstracts. Concrete

items will make more meaning to them than mere theories and abstract concepts. It is for this reason that instructional resources play a bridge between the teacher's knowledge and the pupils understanding. Instructional resources translate and relate general ideas and knowledge into everyday experiences for the pupils (Olufunke, 2012). This helps in the internalization of learning. On the part of the primary school teachers, the instructional resources help the teacher to convey the essence of the science knowledge, reduce the need for over-explanation, and convey knowledge that would have otherwise been impossible to do with just talking. The skill in selecting and utilization of appropriate instructional resources goes a long way in influencing the instructional delivery of science knowledge by primary school teachers to their pupils.

3.3. Curriculum

The Curriculum provides a framework upon which teaching and learning are designed and implemented. The curriculum has a very significant influence on what and how the teacher will teach science subject-matter to the pupils. This influence is based on the characteristics of the curriculum and how it interacts with and through the teacher. There have been arguments that curriculum, should reflect current realities, and that sometimes it is hard to implement (Alao, 2011). Science curriculum should be up-to-date with developments in the field of science. There have been concerns that the primary school science curriculum in Nigeria is anything but up-to-date in this regard. There seems to a lag between what is in the curriculum and the current knowledge in the sciences. This will inadvertently pose a challenge to the primary school teacher as they try to balance the dictates of the curriculum and science development.

Also, another issue with the curriculum is on local content. The Nigeria educational science curriculum, seems not to reflect local content level much. This is unfortunate as learning is a contextualized experience. Teaching within a local context is expected to reflect local realities and experience. By borrowing much from other countries, it becomes a world of abstracts to the pupils who may have no idea of what is been discussed by the teacher.

3.4. Pedagogy

Choice of teaching strategies and teachers' familiarity with them is critical in effective instructional delivery, especially in science subjects. While there are a lot of teaching strategies available from which the primary school teachers' choose from, certain strategies are more suited to certain subject-matter than others (Ishola & Udofia, 2017). In the teaching of sciences, primary school teachers should place emphasis on teaching strategies that allows for hands-on experiences among the pupils, initiates curiosity among the pupils, and encourage pupil's active participation on the teaching-learning process. The primary school teachers will be limited in how effective they can deliver effective science content knowledge to the pupils if they have limited experience in teaching strategies. This will put them at a great disadvantage as it will make their instruction cumbersome, uninteresting and often undercuts the primary objective of teaching; imparting knowledge to the pupils. By being acquainted with sufficient numbers of teaching strategies, the primary school teacher will be able to deploy each at the appropriate time and vary them in order to stimulate interest and learning among the pupils.

4. Educational Implications

The ability of primary school teachers to deliver effective science content knowledge is a reflection of their ability to deliver on their core mandate; imparting meaningful learning to the pupils under their care. One of the consequences of the primary school teachers to deliver science content knowledge is the effect it will have on their self-efficacy. Their effectiveness as teachers are assessed on their ability to impart meaningful knowledge to the pupils based on their ability to deliver science content knowledge. The teacher is expected to prepare and deliver this knowledge to the pupils, with the expectation that it will transfer meaningful learning to them. It therefore behooves on the teacher to display that ability (which encompass knowledge, skills and attitude) to achieve the educational outcomes expected. It has to be said here that while self-efficacy may predispose individuals to achieve certain objectives, it's also true that achieving a goal have an influence on individual's self-efficacy. Therefore, the ability to deliver science content knowledge may have a deeper impact on the teacher.

On the part of the pupils, there are strong evidence that teacher's effectiveness in instructional delivery have a very significant effect on pupils learning outcomes. There is the issue of student's interest and engagement. The ability of teachers to initiate and sustain an effective science content knowledge delivery reflects positively on student's interest and engagement during instruction. There is abundant literature that a clear, concise and stimulating instruction appeals to pupil's sense of curiosity, inquiry and focus on subject-matter. Delivering science content knowledge that is stimulating and understandable to the pupils generates enthusiasm among them and promotes attention to instruction. However, when the instructional delivery is perceived but the pupils as difficult, non-articulated or uninteresting, there are reasons to doubt their continued interest and engagement. At this juncture, what is left for the pupils to do is to embark on rote learning.

Also, teacher's ability to deliver effective science content knowledge to primary school pupils will inadvertently affect their achievement in science subjects. Students' academic achievement is determined by a lot of factors including instructional delivery. Teacher's science content knowledge determines how much information the teacher can be able to transfer to the pupils to make meaningful learning. When this is low, it inadvertently leads to a low level of science knowledge among the pupils, and this will negatively impact on their academic achievement.

5. Conclusion

The science content knowledge of primary schoolteachers has a profound impact on the educational outcomes. It's more so on the pupils who are expected by society to develop into scientists in the future. However, there are certain issues that impinge on the ability of the teachers to develop and deliver effective science content knowledge to the pupils, and this factors inadvertently constrains the teachers in achieving that educational objective, which is to impart meaningful learning to the pupils.

6. Suggestions

It's important to ensure that primary school teachers are equipped and able to deliver science content knowledge to the pupils to ensure learning. Having identified the factors that may limit the achievement of that objective, it's imperative that certain actions be taken to reverse the trend. The essence of refresher programmes is to ensure a continuous development on competences of teachers. One way to improve teacher's content knowledge is to subject them to re-training and development programme. This will expose them to new science content knowledge and strategies of imparting same to the pupils. Also, the teacher should be encouraged to seek out new science information on their own, based on the curriculum, in order to impart relevant and up-to-date knowledge to the pupils.

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