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Research Paper

Teachers' Knowledge of Improvisation of Resources in the Teaching of Biology in Rivers State Secondary Schools

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ABSTRACT: The study investigated teachers' knowledge of improvisation of instructional resources in the teaching of Biology in secondary schools in Rivers State. The study was guided by two research questions and one null hypothesis. The study adopted an analytic-descriptive survey design. The population of the study comprised all Biology teachers' in Rivers State secondary schools. Proportional stratified random sampling and simple random sampling techniques were used in drawing 235 Biology teachers from the three education zones in Rivers State, namely Rivers Central, Rivers East, and Rivers West. Of this sample, only responses from 215 were used for data analysis due to instrument mortality. The instrument used for data collection was the Biology Teachers Improvisation Knowledge Assessment Test (BTIKAT). The instrument had a reliability coefficient of 0.76. The result revealed that there is a significant difference between the percentage of Biology teachers with knowledge and those without knowledge of improvisation of resources. The knowledge level of the biology teachers for improvisation of teaching resources was moderate. Based on the findings, it was recommended, among other things, that improvisation be made a core aspect of methods courses in the training of science teachers.

Keywords: Biology, teachers, improvisation, teaching, resources

INTRODUCTION

Science and technology serve as the bedrock for national development. This is evident in advanced nations like America, Britain, Japan, and others, which, according to Nnoli (2015) and Vikoo (2015), are the most powerful and productive nations of the world due to the special attention given to science and technology as well as their scientific and technological skills. This fact is evident in the premium placed on science and technology by the Federal Republic of Nigeria (FRN, 2008) through the National Policy on Education, which states that special provisions and incentives shall be made for the study of the sciences at each level of the education system. The importance placed on science education by the FRN had been earlier stipulated by the Federal Ministry of Science and Technology that admission into science and non-science courses should be in the ratio of 60:40 for universities and 80:20 for polytechnics and colleges of technology in favour of the sciences.

Science education encompasses the acquisition of scientific knowledge, skills, values, and attitudes, aligning with a fundamental objective of the Nigerian education system—to cultivate practical competencies, mental acumen, physical prowess, and social capacities within individuals, enabling their effective participation in societal advancement (Federal Republic of Nigeria (FRN, 2008).These acquired attributes collectively empower individuals to not only navigate the intricacies of an increasingly scientific and technologically intricate world but also to contribute meaningfully to the progress of their respective societies. The nature of science inherently involves intricate abstractions, often posing challenges for students in their pursuit of comprehension. The nuanced concepts inherent to scientific disciplines are seldom amenable to efficacious instruction through theoretical pedagogies alone. In this context, Kamar and Bello (2017) underscore the notion that the essence of

science is most comprehensively grasped when conveyed through practical applications. Echoing this sentiment, Adeyemi (2008) substantiates this perspective through empirical exploration, highlighting that students exhibit enhanced learning outcomes when engaged in practical activities facilitated by the use of tangible instructional resources.

Biology as a science subject has its own abstract concepts and principles. To enhance students understanding and formation of these abstract concepts and to acquire the necessary skills and attitudes, the teaching of biology should take into consideration both instructional strategies and instructional materials (resources). Good instructional strategies and the use of resources are what make for effective teaching of Biology. These instructional resources are what will motivate the learners and make them enjoy learning, which will eventually lead to the achievement of the learning objectives.

Effective teaching and learning in Biology necessitates a dynamic interplay of diverse instructional materials that facilitate comprehensive understanding and engagement among students. These materials, ranging from visual, audio-visual and laboratory equipment to multimedia resources play a vital role in creating an environment conducive to meaningful learning. However, the availability and adequacy of these conventional resources in the school settings are not always guaranteed, particularly in regions facing resource constraints. In such contexts, the concept of improvisation emerges as a crucial strategy that educators employ to bridge the gap between ideal instructional materials and the reality of limited resources. Resource improvisation can be defined as the innovative utilization of alternative materials and pedagogical techniques by teachers when standard instructional resources are unavailable or insufficient. This approach entails educators leveraging their expertise to creatively design and implement teaching aids that replicate the learning impact of traditional materials. In doing so, educators engage in a process that demands ingenuity, adaptability, and a deep understanding of both the subject matter and the learning needs of students.

Within the sphere of Biology education, where hands-on experiences and visual representations are essential for comprehension, the role of instructional materials is paramount. However, in regions such as Rivers State, Nigeria, where resource constraints are prevalent, the availability of such materials is often limited. The challenge then lies in how effectively biology educators navigate these limitations through resource improvisation, ultimately ensuring that students receive a well-rounded and engaging education despite the constraints.

The provision of necessary materials and equipment to facilitate a meaningful and activity-oriented approach to teaching and learning Biology is frequently deficient or lacking within educational institutions. Various studies (Kamar and Bello, 2017; Nnoli and Okafor, 2017) highlight those vital instructional resources for science education are either absent or notably insufficient across the majority of schools in Nigeria. This dearth of teaching resources is also evident in Rivers State (Arokoyu and Ugonwa, 2012; Beals and Koko, 2019; Mgbomo,2020). These reports underscore that students are not effectively engaging with science subjects, including Biology, in a manner that fosters meaningful comprehension.

Given the absence of these essential resources, it becomes imperative for proficient Biology educators, as well as other science teachers, to seek viable alternatives in order to actualize authentic and effective science education. Consequently, in situations where requisite materials are lacking, educators are compelled to resort to improvisation as the sole recourse. This adaptive strategy becomes the sole avenue through which the teaching and learning process can be facilitated, enabling students to attain the necessary knowledge, skills, and attitudes essential for practical application within society. The prevailing absence and insufficiency of resources indicate a shortfall in government funding allocated to the procurement of essential materials, coupled with a lack of initiative among educators to innovate under such circumstances.

As cited by Ahmed and referenced in Mensah (2015), improvised instructional materials encompass the resources employed by educators when the intended or conventional materials are unavailable, aiming to replicate the same educational impact as standard instructional materials. This process of improvisation necessitates a high level of knowledge on the part of the teacher. This knowledge entails not only an understanding of suitable alternatives but also the ability to create basic tools when required.

While there is a growing body of research that acknowledges the importance of instructional materials and improvisation in education, a noticeable gap remains in the specific context of biology instruction within Rivers State secondary schools. This gap prompts the need for a comprehensive investigation into the extent of biology teachers' knowledge of the concept of resource improvisation, their proficiency in implementing improvisation strategies, and the overall impact of improvisation on the teaching and learning processes. This study aims to address this research gap by examining the knowledge, and practices of Biology teachers regarding the improvisation of instructional resources within Rivers State secondary schools.

Despite numerous studies conducted in this domain, there is a notable absence of empirical investigations into Biology teachers' knowledge regarding the improvisation of teaching resources specifically within the context of Rivers State. Motivated by this research gap, the current study seeks to assess Biology teachers' knowledge with the concept of resource improvisation in the biology

teaching domain. Furthermore, the study aims to evaluate educators' level of expertise in effectively implementing improvisation techniques for teaching resources within secondary educational institutions in Rivers State.

Statement of the problem

Biology by nature has abstract concepts. For students to understand these concepts teaching and learning has to be done effectively with the use of instructional resources. Unfortunately, the teaching resources are either not available or inadequate in most Nigerian schools. This scarcity of teaching resources is also prevalent in Rivers State secondary schools. In situations where these teaching resources are not readily accessible, it is expected of the Biology teacher or any other science teacher to improvise. The absence or inadequacy indicates that government is not providing funds for procurement and there is absence of a culture of improvisation among teachers. Cognizant of the fact that improvisation requires knowledge on the part of the teachers, the problem of the study therefore is to what extent do Biology teachers in Rivers State secondary possess the knowledge to improvise requisite instructional resources for the teaching and learning of Biology?

Aim and objectives of the study

The purpose of the study is to find out whether Biology teachers in secondary schools possess knowledge for improvisation of instructional resources for the teaching and learning of Biology. The objectives are
1. To find out the percentage of Biology teachers who have knowledge for improvisation of teaching resources
2. To ascertain the knowledge level of Biology teachers for improvisation of teaching resources.

Research questions

The study was guided by the following research questions;

1. What is the percentage of Biology teachers with knowledge of improvisation of teaching resources?
2. What is the knowledge level of Biology teachers for improvisation of teaching resources?

Hypothesis

Ho_1: The percentage of Biology teachers with knowledge and those without knowledge respectively for improvisation of teaching resources does not differ significantly.

METHODOLOGY

The study adapted analytic-descriptive survey design. According to Nwankwo (2013), a descriptive survey only aims at collecting on and describing, in a systematic manner, the characteristics, features, and facts of a given population without necessarily testing hypotheses, but when a descriptive survey goes ahead to test hypotheses, the design is regarded as analytic descriptive survey.

Population of the study

The population of this study consists of all Biology teachers in the 268 public secondary schools in the three education zones of Rivers State namely Rivers Central, Rivers East and Rivers West At the time of study, there were 569 Biology teachers in Rivers State, according to data from the Rivers State Senior Secondary Schools Board Planning Research and Statistics Unit, (October 2020)

Sample and sampling

Technique The researcher sampled 235 Biology teachers using proportional stratified random sampling and simple random techniques, as follows: 123 teachers out of 296 teachers from Rivers Central (RC), 50 out of 122 teachers from Rivers East (RE), and 62 out of 150 teachers from Rivers West. However, only 215 teachers' responses were used for data analysis due to instrument mortality.

Instrument for data collection

The instrument used for data collection was a self - designed Biology Teachers Improvisation Knowledge Assessment Test (BTIKAT). The instrument had one section with two parts, part A and part B. Part A consists of a list of 34 standard materials, and Part B consists of a list of alternative materials. The assessment instrument was given a two -point response level of correct and incorrect and weighted 1 and 0 For the 34 item instrument the maximum score was 34. For purpose of dichotomization of respondents into knowledgeable and not – knowledgeable the mean of the total score of all the respondents was determined ,which gave a mean of 14.8. All respondents who scored up to the mean and above were considered as having knowledge of improvisation while all those with scores below the mean were considered as not having the knowledge of improvisation. The instrument was validated by two experts, one in educational measurement and evaluation, and one Biology teacher. The reliability coefficient of the instrument was r = 0.76, obtained through Cronbach alpha as a measure of its internal consistency. Data was analyzed using frequency counts, percentages, means,

and standard deviations for the research questions, while chi-square was used for the hypothesis.

Method of data collection

The assessment instrument was directly administered to the Biology teachers by the researcher and with the help of a research assistant. Instructions pertaining to answering the questions were thoroughly explained to the respondents. Some of the respondents responded to the instrument immediately and they were collected the spot while some which were not responded to on the spot were collected at a later date.

Method of data analysis

Percentage, mean and standard deviation were used in answering research questions while Chi – square was used for the hypothesis

RESULTS

Research Question 1: What is the percentage of Biology teachers with knowledge of improvisation of teaching resources?

Table 1 shows that 37.2 percent of the Biology teachers have knowledge of improvisation of teaching resources, while 62.8 percent do not have knowledge of improvisation of teaching resources. The result is that the majority of the teachers do not have knowledge of improvisation of teaching resources.

Table 1: Percentage analysis of Biology teachers' knowledge of improvisation of teaching resources.

Improvisation knowledge	N	%
Knowledge	80	37.2
Not knowledge	135	62.8
Total	215	100

Criterion mean = 14.8

Research Question 2: What is the knowledge level of Biology teachers for improvisation of teaching resources?

Table 2 shows the mean for the knowledge level of Biology teachers. The observed $\bar{x}$ was 14.80 which falls in the category of moderate level, hence the knowledge level of biology teachers for improvisation of teaching resources can be said to be moderate.

Ho_1: The percentage of Biology teachers with knowledge and those without knowledge respectively for improvisation of teaching resources does not differ significantly.

Table 2: Mean and standard deviation of level of Biology teachers improvisation knowledge (LBTIK).

Variable	N	Sum	$\bar{x}$	SD	Remark
LBTIK	215	3182	14.80	5.95	ML

ML = Moderate level

Table 3 shows that 37.2 percent of the Biology teachers have knowledge of improvisation of teaching resources, while 62.8 percent do not have knowledge of improvisation of teaching resources. When these observations were subjected to chi-square (X^2) analysis, the calculated X^2 (14.070) at df 1 had a significant value of 0.000, which is less than the chosen level of significance (0.05) and thus significant. This implies that the null hypothesis stated here is hereby not accepted (rejected). The result is that there is a significant difference between the percentage of Biology teachers with knowledge and those without knowledge, respectively, for the improvisation of teaching resources.

DISCUSSION

The study has brought to light a noteworthy disparity between the proportion of Biology teachers possessing knowledge of improvisational techniques and those lacking such knowledge. The implications drawn from the study's findings are indicative of a prevailing deficiency in the awareness and application of resource improvisation among the majority of Biology educators. This conspicuous absence of improvisational expertise can potentially be attributed to various underlying factors. It is conceivable that the inadequate exposure to improvisation strategies during the training of these Biology teachers within their preparatory institutions might have contributed to this outcome, where improvisation might not have been emphasized significantly within methodological courses. This aligns with the conclusions drawn from previous research endeavors, including those of Anibueze (2016), Ogbu (2016), Salami and Olotu (2014), and Utibe-Abasi (2015), which mirror the findings of the current study.

However, an alternative perspective is presented by the investigations conducted by Aina (2013), Ajuzie (2015), and Akukwe (2015), where their results diverge from the present study's outcomes. Notably, these studies employed comparably smaller sample sizes—70 and 158 mathematics teachers, respectively—contrasting with the larger sample size of 215 Biology teachers engaged in the current study. It is plausible that the size of the sample in these prior studies exerted an influence on the observed outcomes.

Moreover, the findings signify that the knowledge proficiency of Biology teachers within Rivers State, with regard to improvising teaching resources, can be characterized as moderate. The inferences drawn from

Table 3: Chi – square analysis of percentage difference in Biology teachers' knowledge of improvisation of teaching resources.

Improvisation knowledge	Observed N	Sample %	Expected E	O-E	χ^2	df	sig	Dec
Knowledgeable	80	37.2	107.5	-27.5	14.070*	1	0.00	Sig
Non-knowledgeable	135	62.8	107.5	27.5				
Total	215	100	215	0				

*Significant, P (.000) < 0.05 level of significance

the study suggest that Biology teachers generally lack a comprehensive understanding of alternative instructional materials suitable for classroom scenarios wherein standard materials are unavailable. The observed moderate level of improvisational knowledge could potentially be attributed to limited exposure and an inherent inability among teachers to contemplate suitable alternatives in situations of scarcity.

In congruence with the present study's findings, similar results have been documented by Achimugu and Onojah (2017), Mensah (2015), and Salami and Olotu (2014), who reported that educators tend to possess average or rudimentary levels of knowledge regarding the improvisation of instructional materials. However, opposing conclusions were drawn by Odu (2013), whose research indicated that teachers exhibited a lower proficiency in improvising instructional materials. It is plausible that the dissimilar outcomes between the current study and Odu (2013) can be attributed to differences in sample size, given the present study's utilization of a larger sample size of 215 Biology teachers as opposed to Odu smaller sample size of 100 teachers.

Conclusion

In conclusion, this study has shed light on the critical aspect of resource improvisation within the realm of Biology education in Rivers State secondary schools. The findings of this research have illuminated the prevailing state of knowledge of Biology teachers regarding the improvisation of instructional resources, providing valuable insights into the challenges and opportunities that teachers face in their pursuit of effective science teaching. The evident dearth in the knowledge and application of improvisational strategies among the majority of Biology teachers serves as a significant focal point. This scarcity of knowledge can potentially be attributed to a variety of factors, including the absence of comprehensive training in improvisation during the formative years of these educators' professional development. The moderate knowledge proficiency levels observed among Biology teachers in terms of improvisation of teaching resources are indicative of an intermediate understanding, suggesting room for improvement. The inherent challenges of limited exposure and an inclination toward conventional instructional methods may hinder Biology teachers from fully capitalizing on improvisational opportunities, especially in times of material scarcity. In essence, the findings provide a comprehensive understanding of the current landscape of resource improvisation within Biology teachers in Rivers State.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Biology teachers should take it upon themselves to belong to STAN and attend conferences and workshops annually to update their knowledge.
2. The state government, in conjunction with the ministry of education, should from time to time organise workshops for teachers as a form of in-service training.
3. Science teachers' education programme should make improvisation a core aspect of method courses to enrich pre-service teachers with knowledge of improvisation.

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