AVAILABILITY AND UTILIZATION OF INSTRUCTIONAL MATERIALS FOR TEACHING CHEMISTRY IN SECONDARY SCHOOLS IN DUTSIN-MA ZONAL EDUCATION QUALITY ASSURANCE, KATSINA STATE

Zubairu Hamisu, Ukor Denen Daniel
&
Prof. Kayode John Olasehinde
Department of Science Education
Faculty of Education
Federal University, Dutsin-Ma
08061614384, Email: zubairuhamisu26@gmail.com

Abstract
The study examined the availability and utilization of instructional materials for teaching Chemistry in secondary schools in Dutsin-Ma zonal education quality assurance, Katsina state. Three objectives, research questions and hypotheses have guided the study. The study used the descriptive survey research design. The population comprises 23 Chemistry teachers with the sample size of 17 teachers selected through purposive sampling technique to exclude schools with serious security issues. The instrument used for data collection was availability and utilization of instructional material questionnaire (AUIMQ) for Chemistry teachers with the reliability coefficient of 0.88. Descriptive statistics including mean and standard deviation were employed to answer all research questions and independent sample t-test was employed to test all the hypotheses. The major finding from the study shows that: there is no significant difference in the availability of instructional materials for teaching Chemistry between urban and rural senior secondary schools in Dutsin-Ma. There is no significant difference in the utilization of instructional materials between male and female Chemistry teachers in senior secondary schools in Dutsin-Ma**.** There is a significant difference between the types of challenges faced by male and female Chemistry teachers in their access to and utilization of instructional materials in teaching Chemistry in Dutsin-Ma. It was recommended among others that: there should be comprehensive teacher training programmes to ensure effective utilization of instructional materials. Teachers should always be encouraged to use instructional materials during instruction in the classroom.

Keywords: Availability, Utilization, Instructional Materials, and Chemistry

Introduction

In a subject like Chemistry, the teaching process heavily relies on the availability and effective utilization of instructional materials to facilitate learning and promote understanding of complex scientific concepts. Instructional materials in science education include laboratory apparatus, textbooks, charts, models, digital resources, and other teaching aids that enhance the delivery of lessons and engage students in active learning.

All science courses, especially Chemistry, call for a number of teaching and learning resources. Instructional resources help learners receive messages, information, ideas, and knowledge (Estai & Bunt, 2016; Prachagool & Nuangchalerm, 2019). Students may find some of the concepts covered in Chemistry which they may likely find to be abstract (Etobro & Fabinu, 2017). It has been discovered that using educational tools to teach Chemistry produces consistent results for the subject's concreteness. All the resources Chemistry teachers need to give their pupils an engaging and memorable education are included in the broad concept of instructional materials. Scientific courses in general, and Chemistry in particular, require copious amounts of teaching and learning materials. Instructional resources assist students in

receiving messages, information, concepts, and knowledge through communication channels (Estai & Bunt, 2016; Prachagool & Nuangchalerm, 2019. These teaching materials provide Chemistry teachers with all the tools they need to provide their students with interesting and lasting education. Instructional resource is a very important concept in education and has gained a lot of attention in teacher education. Instructional resource is powerful media to enhance learning and make it more interesting, interactive, and exciting to all categories of learners with the aim of achieving instructional objectives or outcomes. Furthermore, instructional resource assist teachers to transmit knowledge in an impressive way making learning more effective as they help learners in greater acquisition of knowledge. It encourages participation, especially if students are allowed to manipulate materials used. Hands-on instructional materials show, rather than tell, which increase information retention (Kos et al., 2021). Schools should base instructional resource on fundamental scientific concepts and principles, which help to align students understanding with current knowledge and teach them to monitor and control their own thoughts, to facilitate learning. The pupils taught with various instructional resources have excellent achievement as compared with those taught without various instructional materials. Hence, it is clear that any effort to enhance effective teaching and learning of Chemistry will encompass the availability and use of instructional materials (Abidoye et al., 2022).

In Nigeria, the education system faces several challenges, including limited resources, inadequate infrastructure, and insufficient funding, particularly in rural and semi-urban areas. Schools in these areas often struggle with the availability of instructional materials, and even when they are available, their utilization may be suboptimal due to factors such as lack of teacher training, poor maintenance, or overcrowded classrooms. These challenges are pronounced in science subjects like Chemistry, which require well-equipped laboratories and continuous hands-on practice (Ansayam & Tan, 2021). Ibe (2014) is of the opinion that the use of instructional materials to facilitate teaching and learning should be a welcome development. This is in conformity with Dike (2013) who asserts that science teachers should work beyond stereotyped science teaching-learning process and utilize the available materials in the environment to facilitate science teaching-learning process. Therefore, for effective teaching of science subjects like Chemistry, the use of instructional materials to enrich instruction is very vital

According to Adeboye (2022) Instructional materials can be classified by type, including print, visual, and audiovisual, among others: Thus, print includes: textbooks, pamphlets, handouts, study guides, manuals, blackboard and whiteboard. Audio include: cassettes, microphones, podcasts, CDS. Visual: charts, real objects, photographs, transparencies. Audiovisual include: slides, tapes, films, filmstrips, television, video, multimedia, DVDs. electronic interactive include: computers, graphing calculators, tablets

Statement of the Problem

Chemistry instruction in senior secondary schools should ideally combine theoretical and practical learning, supported by sufficient teaching resources. For the purpose of providing high-quality science instruction, certain resources such as lab equipment, chemical reagents, visual aids, models, and updated textbooks are essential. When accessible and appropriately used, they improve students' comprehension of abstract Chemistry ideas, encourage hands-on

learning, and support increased academic achievement and enthusiasm for science-related vocations (Adeyemo, 2020; Ahmed, 2022). Under such a perfect world, students would gain a solid foundation in Chemistry, which would allow them to go into science-related careers and succeed in external exams.

But the current situation is far from ideal in many of the schools in Katsina state's Dutsin-Ma ZEQA. Many senior secondary schools lack the teaching resources needed to teach chemistry effectively, particularly those in rural and semi-urban settings. Because laboratories are occasionally either nonexistent or inadequately equipped, teachers are compelled to mostly rely on theoretical instruction without any hands-on demonstrations (Usman & Ameen, 2021). When resources are available, they are frequently underutilized because of things like inadequate upkeep of items, a lack of teacher preparation, or overcrowded classrooms (Mustapha, 2023).

Objectives of the Study

1. Assess the availability of instructional materials for teaching Chemistry in senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state.
2. . Examine how effectively the Chemistry teachers utilize available instructional materials in senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state.
3. Identify the challenges faced by the teachers in accessing and using instructional materials for teaching Chemistry in Dutsin-Ma zonal quality assurance Katsina state

Research Questions

1. What is the extent of availability of instructional materials for teaching Chemistry in senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state?
2. How effectively do teachers utilize available instructional materials in teaching Chemistry at the senior secondary school level in Dutsin-Ma zonal quality assurance Katsina state?
3. What are the challenges faced by Chemistry teachers in accessing and utilizing instructional materials for teaching Chemistry in Dutsin-Ma zonal quality assurance Katsina state?

Hypotheses

$H0_1$: There is no significant difference in the availability of instructional materials for teaching Chemistry between urban and rural senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state.

$H0_2$: There is no significant difference in the utilization of instructional materials between male and female Chemistry teachers in senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state.

$H0_3$: There is no significant difference between the types of challenges faced by male and female Chemistry teachers in their access to and utilization of instructional materials in teaching Chemistry in Dutsin-Ma zonal quality assurance Katsina state.

Methodology

The study adopts a descriptive survey design. The study population comprise of all the 23 Chemistry Teachers within Dutsin-Ma Zonal Education Quality Assurance Katsina State. A purposive sampling technique is applied to select the sample for this study. However, the sample size of the study was 17 Chemistry teachers. The instrument utilized for data collection was Availability and Utilization of Instructional Materials Questionnaire (AUIMQ) for Chemistry Teachers. AUIMQ, was validated by two experts one specialized in chemistry education and second one in educational technology in the Department of Science Education,

Federal University Dutsin-Ma. A pilot test was conducted by the researcher with the Chemistry teachers and was subjected to Cronbach's alpha coefficient. The reliability coefficient obtained was 0.88 which shows the high reliability index.

Data from the questionnaires is analyzed using descriptive statistics, including means, and standard deviations to summarize the availability and utilization of instructional materials. The t-test independent sample was employed to test all the hypotheses at 0.005 level of significance.

Results

Research Question one: What is the extent of availability of instructional materials for teaching Chemistry in senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state?

Table 1: Mean and Standard Deviation Scores of the Responses on Extent of Availability of Instructional Materials

Statement	Mean	SD	Decision
Up-to-date Chemistry textbooks	1.59	.870	Available
Visual aids, such as charts and diagrams, for all students.	1.82	.639	Available
Laboratory equipment (e.g., test tubes, beakers, Bunsen burners)	1.47	.717	Highly Available
Audio-visual aids (e.g., projectors, instructional videos)	1.59	.712	Available
Computer or digital resources	1.35	.493	Highly Available
Physical models (e.g., molecular structure models)	1.41	.618	Highly Available
Chemicals and reagents needed for practical experiments	1.41	.618	Highly Available
There are printed or digital manuals	1.53	.514	Available
Reference books and supplementary materials	1.35	.606	Highly Available
Laboratory safety equipment (e.g., gloves, goggles)	1.18	.393	Highly Available
Group mean	1.47		Highly Available

Table 1 revealed that the in the senior secondary schools in Dutsin-Ma, up-to-date Chemistry textbooks, visual aids such as charts and diagrams for all students, audio-visual aids (e.g., projectors, instructional videos) and printed or digital manuals for teaching Chemistry are available while laboratory equipment (e.g., test tubes, beakers, Bunsen burners), computer or digital resources, physical models (e.g., molecular structure models), Chemicals and reagents needed for practical experiments, Chemicals and reagents needed for practical experiments, reference books and supplementary materials and laboratory safety equipment (e.g., gloves, goggles) are highly available. In general, the group mean of the responses of respondent on the level of availability of instructional materials for teaching Chemistry in senior secondary schools in Dutsin-Ma is 1.47. This implies that instructional materials for teaching Chemistry in the senior secondary schools in Dutsin-Ma are highly available.

Research Question Two: How effectively do teachers utilize available instructional materials in teaching Chemistry at the senior secondary school level zonal quality assurance Katsina state?

Table 2: Mean and Standard Deviation Scores of the Teacher's Responses on Effective Utilization of Instructional Materials

Statement	Mean	SD	Decision
Chemistry textbooks to support classroom teaching.	2.06	. 966	Utilized Sometimes
Visual aids like charts, diagrams, and periodic tables used in teaching.	2.18	.728	Utilized Sometimes
Laboratory equipment used for hands-on experiments in Chemistry classes.	2.18	. 728	Utilized Sometimes
Teachers integrate audio-visual aids (e.g., videos, projectors) into Chemistry lessons.	2.35	. 493	Utilized Sometimes
Digital resources (online simulations used to enhance Chemistry understanding).	2.00	. 791	Utilized Sometimes
Physical models (e.g., molecule models) employed to explain complex Chemistry concepts.	2.24	. 664	Utilized Sometimes
Group activities that utilize instructional materials.	2.00	. 935	Utilized Sometimes
Chemistry assignments or projects often involve the use of instructional materials.	1.88	. 697	Utilized Sometimes
Practical lab work included in the Chemistry lesson plans.	1.82	. 728	Utilized Sometimes
Teachers encourage students to utilize available reference materials for independent study.	1.76	. 831	Utilized Sometimes
Group mean	2.05		Utilized Sometimes

Table 2 revealed that the in the senior secondary schools in Dutsin-Ma, each of the instructional material assess is sometimes utilized. In general, the group mean of the responses of respondent on the level of effective utilization of instructional materials for teaching Chemistry in senior secondary schools in Dutsin-Ma is 2.05 This implies that the teachers of senior secondary schools in Dutsin-Ma sometimes utilize instructional materials for teaching Chemistry based teacher's response.

Research Question three: What are the challenges faced by Chemistry teachers in accessing and utilizing instructional materials for teaching Chemistry zonal quality assurance Katsina state?

Table 3: Mean and Standard Deviation Scores of the challenges faced by schools and teachers in accessing and utilizing instructional materials

Statement	Mean	SD	Decision
Limited funding affects the ability to obtain adequate instructional materials.	2.24	.831	Agree
Teachers lack sufficient training on effectively using of available instructional resources.	2.24	.752	Agree
There is a shortage of Chemistry lab technicians to manage and maintain lab equipment.	2.24	.831	Agree
Some instructional materials are outdated and do not align with the current curriculum.	2.53	.800	Disagree

Large class sizes make it difficult to effectively use hands-on materials in class.	2.29	.588	Agree
Insufficient safety equipment discourages the frequent use of the laboratory.	2.06	.899	Agree
Lack of internet connectivity limits the use of online resources and digital materials.	1.88	.928	Agree
Time constraints within the school schedule hinder the use of interactive instructional tools.	1.88	.993	Agree
Teachers feel that administrative support for resource maintenance is inadequate.	2.06	1.249	Agree
There is a lack of student motivation to engage with instructional materials provided.	2.12	1.054	Agree
Group mean	2.15		Agree

Table 3 revealed that the Chemistry teachers in the senior secondary schools in Dutsin-Ma agree with all the identified challenges to accessing and utilizing instructional materials for teaching Chemistry except that bordering on "Some instructional materials are outdated and do not align with the current curriculum". In general, the group mean of the responses of respondent on the challenges faced by schools and teachers in accessing and utilizing instructional materials for teaching Chemistry was 2.15. This implies that there is high-level challenges faced by the Chemistry teachers in accessing and utilizing instructional materials for teaching Chemistry.

Ho_1: There is no significant difference in the availability of instructional materials for teaching Chemistry between urban and rural senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state.

Table 4: *t*-test Analysis of the Difference in the Availability of Instructional Materials between Urban and Rural

School Location	N	Mean	SD	df	t-value	P-value	Decision
Urban	9	14.22	1.86	15	-1.000	0.333	**Ho_1** Not Rejected.
Rural	8	15.25	2.38				

Table 4 reveals that the difference in the availability of instructional materials between Urban (M = 14.22, SD = 1.85) and Rural (M = 15.25, SD = 2.37) is not significant, t(15) = 1.000, p = 0.333. Consequently, this study retained the hypothesis that says there is no significant difference in the availability of instructional materials for teaching Chemistry between urban and rural senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state.

Ho_2: There is no significant difference in the utilization of instructional materials between male and female Chemistry teachers in senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state.

Table 5: t-test Analysis of the Difference in the Utilization of Instructional Materials between Male and Female Chemistry teachers

Gender	N	Mean	SD	df	t-value	P-value	Decision
Male	11	20.45	2.97	15	0.035	0.973	**Ho_2** retained
Female	6	20.50	1.51				

Table 5 reveals that the difference in the utilization of instructional materials between the male (M = 20.45, SD = 2.97) and female (M = 20.50, SD = 1.51) teachers is not significant, t(15) = 0.035, p = 0.973. Consequently, this study retained the hypothesis that says there is no significant difference in the utilization of instructional materials between male and female Chemistry teachers in senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state

$H0_3$: There is no significant difference between the types of challenges faced by male and female Chemistry teachers in their access to and utilization of instructional materials in teaching Chemistry in Dutsin-Ma zonal quality assurance Katsina state.

Table 6: t-test Analysis of the Difference in the challenges faced by male and female Chemistry teachers in their access to and utilization of instructional materials

Gender	N	Mean	SD	df	t-value	P-value	Decision
Male	11	20.09	3.38	15	-2.559	0.022	Rejected.
Female	6	24.16	2.56				

Table 6 reveals that the difference in the challenge of Instructional Materials between the male (M = 20.09, SD = 3.38) and female (M = 24.16, SD = 2.56) teachers is significant, t (15) = = -2.559, p = 0.022. Consequently, this study rejected the hypothesis that says there is no significant difference between the types of challenges faced by male and female Chemistry teachers in their access to and utilization of instructional materials in teaching Chemistry in Dutsin-Ma zonal quality assurance Katsina state.

Discussion of Findings

The result of these findings revealed that there is no significant difference in the availability of instructional materials for teaching Chemistry between urban and rural senior secondary schools in Dutsin-Ma ZEQ. However, the senior secondary schools in Dutsin-Ma have highly level of availability of instructional materials for teaching Chemistry. The result disagreed with that Ehirim, Iwuchukwu, and Okenyi, (2020) investigated the availability and utilization of instructional materials in the teaching and learning of Chemistry at the senior secondary. Their findings showed that many instructional materials were available. However, the result agreed with that of Odeyemi, (2023) conducted a study investigated on availability and utilization of instructional materials for the implementation of the national upper basic information technology curriculum in south east Nigeria. Their findings among other things revealed that some of the instructional materials which were meant to use in the implementation of the national upper basic information technology curriculum were not available for use in most of the schools.

The result also revealed that there is no significant difference in the utilization of instructional materials between male and female Chemistry teachers among senior secondary schools in Dutsin-Ma and the teachers of senior secondary schools in Dutsin-Ma have moderate level of effective utilization instructional materials for teaching Chemistry. The result agreed with that of Onajite, et al., (2019) carried out a study and examined teachers' utilization of instructional materials for effective teaching of business studies in junior secondary schools in Delta State. Findings of the study revealed among others that business studies teachers' utilization of instructional materials such as printed and non-printed materials for effective teaching of the subject in junior secondary schools in Delta state was to a low extent, which was minimal. The result also was in line with that of Iyorhii, and Mando, (2024) conducted a study to examine the extent of resource provision and utilization for quality instructional delivery in federal universities in North Central Zone, Nigeria. The findings revealed that there is no significant

difference between the opinions of academic staff and heads of units on the extent resources are provided and utilized in federal universities.

Finally, the finding revealed that there is a significant difference between the types of challenges faced by male and female Chemistry teachers in their access to and utilization of instructional materials in teaching Chemistry in Dutsin-Ma and the challenges faced by schools and teachers in accessing and utilizing instructional materials for teaching Chemistry were: Limited funding, Teachers lack of sufficient training, shortage of Chemistry lab technicians. Some instructional materials are outdated and do not align with the current curriculum, large class sizes, lack of internet connectivity and time constraints within the school schedule. The finding agreed with the study conducted by Chigbu and Adamu (2023) on their study that addresses the critical issue of how instructional materials impact curriculum development in the Nigerian educational system. The result revealed that the challenges such as inadequate funding, logistical issues in distribution, and the scarcity of culturally appropriate resources impede their effectiveness. Additionally, the digital divide and lack of teacher training in using these materials effectively emerged as significant barriers. Consequently, the study recommends increased financial investment in education to develop and distribute high-quality, relevant instructional materials.

Conclusion

Based on the findings of this research, it can be concluded: urban senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state significantly have similar level of availability of instructional materials for teaching Chemistry with rural senior secondary schools. The senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state have highly level of availability of instructional materials for teaching Chemistry. Male and female Chemistry teachers significantly have similar opinion on the utilization of instructional materials among senior secondary schools and the teachers of senior secondary schools in Dutsin-Ma zonal quality assurance Katsina state have moderate level of effective utilization instructional materials.

Both male and female Chemistry teachers significantly have difference level of challenges faced in their access to and utilization of instructional materials in teaching Chemistry and the challenges faced by Chemistry teachers in accessing and utilizing instructional materials for teaching Chemistry were: limited funding, teachers lack of sufficient training, shortage of chemistry lab technicians, some instructional materials are outdated and do not align with the current curriculum, large class sizes, lack of internet connectivity and time constraints within the school schedule.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Teachers should always use instructional materials during instruction in the classroom.
2. The Ministry of Educations should partner with the non-governmental agencies like New Globe, in acquiring more instructional educational resources for secondary schools in Katsina state.
3. There should be comprehensive teacher training programmes to ensure effective utilization of these materials.

References

Abidoye, F. O., Aliyu, M. Z., Ahmed, A. R., & Oluwole, O. S. (2022). Instructıonal resources for teachıng bıology ın secondary schools ın Moro, Kwara State-Nigeria. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, *8*(2), 187-193.

Adeboye, M. O. (2022). Effects of Thinking Map and Experiential Strategy on Pupils' Basic Science Academic Performance in Ilorin South Local Government Area, Kwara State (Master's thesis, Kwara State University (Nigeria)).

Adeyemo, A. (2020). The role of instructional materials in the teaching of science subjects. *Science Journal of Education, 8*(4), 112-121.

Ansayam, M. P., & Tan, D. A. (2021). Investigating the utilization of digital instructional materials and digital tools for online learning in teacher education courses. *International Journal of Scientific & Technology Research, 10*(9), 125-137.

Barrera, R. (2022, December). Availability of instructional materials model of the technical-vocational livelihood curriculum implementation for public senior high schools. In *International Conference on Emerging Technology and Interdisciplinary Sciences* (pp. 89-113).

Chigbu, P. O., & Adamu, M. A. (2023). Instructional Materials and Curriculum Development in Nigerian Educational System: Challenges and Prospects. *International Journal of Formal Education,* 2(12), 392-406.

Dike, R. C. (2013). Impact of substituting standard materials with local materials on Chemistry achievement and interest of senior secondary school students in Imo state Nigeria. An Unpublished Thesis submitted to the School of Postgraduate Studies, NnamdiAzikiwe University, Awka.

Ehirim, A. I., Iwuchukwu, P. I., & Okenyi, B. E. (2020). Availability and utilization of instructional materials in the teaching and learning of Chemistry in secondary schools in a council area of Imo State, Nigeria. *Asian Journal of Education and Social Studies*, *9*(3), 26-38.

Estai, M., & Bunt, S. (2016). Best teaching practices in anatomy education: A critical review. *Annals of Anatomy-Anatomischer Anzeiger*, *208*, 151-157.

Etobro, A. B., & Fabinu, O. E. (2017). Students' perceptions of difficult concepts in Biology in senior secondary schools in Lagos State. *Global Journal of Educational Research, 16(*2), 139-147.

Iyorhii, D. C., & Mando, P. N. (2024). Resource Provision and Utilization for Quality Instructional Delivery in Federal Universities in North Central Zone, Nigeria. *Scholar J-Science and Education, 2*(1).

Kos, M., Jerman, J., & Torkar, G. (2023). Preschool children's attitude toward some unpopular animals and formation of a positive attitude toward them through hands-on activities. *Journal of Biological Education*, *57*(1), 83-100.

Odeyemi, O. S. (2023). Availability And Utilization of Instructional Materials in the Teaching of Mathematics in Ibadan South West Local Government Area of Oyo State, Nigeria.

Onajite, G. O., Olaniyi, O. N., Oyerinde, D. O., Onyesom, M., & Aina, M. A. (2019). Teachers utilization of instructional materials for effective teaching of business studies in junior secondary schools in Delta State. *Social Sciences*, *10*(6), 27-37.

Prachagool, V., & Nuangchalerm, P. (2019). Investigating the nature of science: An empirical report on the teacher development program in Thailand. *Jurnal Pendidikan IPA Indonesia*, *8*(1), 32-38.

Zhang, S., Shen, J., & Yan, J. (2023). Children's E-Learning Interactions and Perceived Outcomes with Educational Key Opinion Leaders in China. *Communications of the Association for Information Systems*, *53*(1), 423-443.