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The aim and scope of the journal is to provide an academic medium and an important reference for the advancement and dissemination of information that supports high level learning, teaching and research in the fields of Sciences, Technology, Education and Mathematics.

The articles in this volume are academic and professional discourse written by reputable scholars in their area of specialization.

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FORWARD

On Behalf of the staff and students of the Department of Science Education, Federal University Gusau, Zamfara state, Nigeria, we humbly acknowledge and thank Allah (S.W.T) the most beneficent, the most merciful for without his will, collection and computation of this journal publication would not have been possible. May all praise be ascribed unto Him. The department is sincerely grateful to its accommodating mentor Prof. M.G. Abubakar, Vice Chancellor, Federal University, Gusau and his management team for giving the department enabling environment for academic activities. The department's profound gratitude goes to Dr. Umar Sodangi who doubled as the Dean, Faculty of Education, Federal University, Gusau and Associate Editor of Zamfara International Journal of Science, Technology, Education and Mathematics (ZIJSTEM). Furthermore, Special gratitude goes to our contract and visiting Professors, the staff and students of the Department of Science Education, Federal University, Gusau, for their supports and foresight towards actualizing the dream of the department.

The Zamfara International Journal of Science, Technology, Education and Mathematics (ZIJSTEM) is a brain child of Department of Science Education with the aim of bringing science and technology education into global and well recognized journals of science and technology education research. This is first of its kind, among Science Education Departmental Journals in Northwest, Nigeria and by extension one of the highly placed departmental journals in Nigeria, considering its online visibility and originality, based on well-known global best practices.

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The Zamfara International Journal of Science, Technology, Education and Mathematics (ZIJSTEM) calls for scholarly articles for review and possible publication in its next edition (Volume 2, Number 3.), ZIJSTEM publishes articles that emphasizes on research development and application within the field of Sciences, Technology, Education and Mathematics. All manuscripts are reviewed by editorial review committee. Contributions must be original, not previously or simultaneously published elsewhere, and are critically reviewed before they are published. Papers, which must be written in English language, should have good grammar and proper terminologies.

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abdullahiyakub@fugusau.edu.ng

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Impact of Hausa-Chemistry-Practical-Module on Achievement in Science-Process-Skills among Secondary School Chemistry Students in Minna, Niger State, Nigeria

SALIHU, Fatima¹

E-mail: ummuaisha440@gmail.com¹

Phone No: +234-703-970-2424

NDATSU, A.¹

abdulkadir.ndatsu@futminna.edu.ng

+234-806-453-1808

YAHAYA, F.¹

Yahaya.fatima@futminna.edu.ng³

+234-706-812-9557

ALI, Fati¹

fati.ali@futminna.edu.ng

+234-803-517-9715

CHADO, A. M.¹

chado.amina@futminna.edu.ng

+234-803-596-5345

Department of Science Education, Federal University of Technology, Minna, Nigeria¹

Abstract

The study developed and validated a Hausa Chemistry practical module for integrating science process skills among secondary school students in Minna, Niger state. This study employed the design and development research approach to establish an empirical basis for creating the Hausa Practical Module, a self-instructional module. In particular, the researcher utilised the ADDIE (Analysis, Design, Development, Implementation, Evaluation) Model in developing the Hausa Practical Module in Volumetric Analysis. The total population was twelve thousand four hundred and thirty-three (12433). The students in each of the intact classes will constitute the sample size (414, as obtained from the Rao soft Sample Size Calculator) to be used for the study. Two research questions were raised. Six experts validated the research instrument used for the study. Three instruments were used for this study. A Test-Retest Method was used to administer the CPATEL and CPATHL, i.e. the students were given the CPATEL and CPATHL multiple-choice items with four options A-D after one week, and the same test was re-administered to the same group of students. The results of the first test and the second were subjected to Pearson's Product-Moment Correlation Coefficient (r), and their correlation coefficient indexes of 0.89 for the CPATEL and 0.81 for the CPATHL, meaning the two instruments are reliable for the study.

Keywords: Hausa Practical Module and Science process skills.

Introduction

Chemistry instruction accentuates understanding and establishing the relationship between the students' knowledge and intuition about the concrete structure and theoretical nature of Chemistry, and because of its abstract nature, Chemistry is also usually a subject that is best endured rather than enjoyed by most young learners who are not well grounded in learning and studying Chemistry concepts. As an educationist, it is thus significant to explore how instructional design can be used in a traditional learning environment to enhance the teaching and learning of Chemistry concepts. Instructional design, which involves the systematic development of instructional materials and activities, ensures that learners achieve specific learning goals or educational outcomes reflected in the education curriculum and also provides relevant instructions suitable for a wide range of learning environments in schools at all times (Torrefranca, 2017).



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Impact of Hausa-Chemistry-Practical-Module on ... Salihu, F., Et. al. (2025)

One of the important educational innovations in instructional design that can complement traditional face-to-face instruction is programmed instruction in module form. This approach, often called the Modular Approach, consists of self-directed learning activity packets that are self-instructional, self-paced, student-directed, and place the responsibility of learning on the students. The basic principles of modular instruction involve the division of the curriculum into limited units or modules of learning, which are assessed at the end of that unit, with the student building up a degree through such learning being credited (Torrefranca, 2017). Through this method, the teacher sheds the role of presenter, demonstrator, driller, and questioner, and now takes on the role of facilitator, initiator, monitor, coach, and coordinator. More importantly, it provides students with opportunities to direct their learning while constructing meaningful experiences about the concepts being taught, which can be done in any mother tongue, not just English. In learning, the use of Mother Tongue Language(s) can play an important role, because without language communication in any given society may be difficult to comprehend, and these languages come in different forms and types for instance English, Latin, Spanish, Arabic, Yoruba, Igbo, Gbaygi, Nupe, and Hausa which are all examples of Mother Tongue all over the world (Anna and Ericson, 2018).

In the same vein, Mother tongue is the first language one learns as a baby, the language one grows up knowing, which is also known as the native language of that particular child. A child first comprehends what is around them through the language the child hears his/her mothers communicate with and use daily. Also, the mother tongue is central in framing the thinking and emotions of individuals learning in school with the use of that particular language and it is an influential tool in advancing the learning of an individual or persons, the mother tongue also largely refers to not only the language one learns from one's mother but also the speaker's dominant and home language within a given community that is, the native language of that community for example in Nigeria Yoruba, Igbo, Gbaygi, Nupe and Hausa are few but native languages in the country that are used in daily activities and in almost all the communities, schools, markets within the country (Ali, et. al., 2014). Hausa is a major Mother Tongue Language with more first-language speakers than any other sub-Saharan African language with – an estimated population of 50 million speakers or more – most of whom live in Northern Nigeria and the Southern Republic of Niger. Mother-tongue speakers of Hausa include many ethnic groups in Nigeria, including the Fulani, amongst others. The Hausa language can also be used as a medium of instruction in a class to teach science courses like Chemistry.

Chemistry is a sub-discipline of science that deals with the study of matter and the substances that constitute it. It also deals with the properties of these substances and the reactions undergone by them to form new substances. Chemistry primarily focuses on atoms, ions, and molecules, which, in turn, make up elements and compounds. These chemical species tend to interact with each other through chemical bonds. It is important to note that the interactions between matter and energy are also studied in the field of chemistry. The five primary branches of chemistry are Physical chemistry, Organic Chemistry, Inorganic chemistry, Analytical chemistry, and Biochemistry. Apart from these primary branches, there exist several specialised fields of chemistry that deal with cross-disciplinary matters. Some such examples include Medicinal chemistry, Neurochemistry, Material Chemistry, Nuclear Chemistry, Environmental chemistry, Polymer chemistry, and Thermochemistry. All these branches of chemistry are taught to students in senior secondary schools in the form of theory and practical (Gebrekidan, et. al, 2014).



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Practical work carried out by students themselves is an essential part of Chemistry, although critical views on its effectiveness also exist. Many chemistry education researchers believe that students' practical work improves their learning of science. It is on this basis of the above that Gebrekidan, et. al., (2014), for example, opined that “laboratory experiences have been purported to promote central science education goals, including the enhancement of students’ abilities; scientific practical skills and problem-solving abilities; scientific ‘habits of mind’; understanding of how science and scientists’ work; as well as interest and motivation”. Chemistry without practical work was seen as a body of factual information and general laws, which conveyed nothing of lasting power to the mind. In this study, the term 'practical', as it is commonly used in the science education literature, refers to any type of science teaching and learning activity in which students are expected to be working either individually or in groups, interact with materials to observe and understand the natural world specifically in Chemistry (Gebrekidan et. al, 2014).

Accordingly, central to the teaching-learning process in the secondary chemistry curriculum is practical work geared towards mastery of scientific skills: process skills, manipulative skills, and critical thinking skills. More specifically, after completion of their upper secondary chemistry syllabi students are expected to use scientific methods in solving problems; and demonstrate an understanding of experimental skills, knowledge of laboratory procedure, and scientific inquiry skills including observing, inferring, predicting, comparing and contrasting, communicating, analysing, classifying, applying, theorizing, measuring; asking questions, developing hypotheses, performing and designing experiments, interpreting data, drawing conclusions, making generalizations and problem-solving for better academic achievement of students (Anna and Ericson, 2018).

Achievement is defined as the measure of accomplishment in a specific field of study within a specific period. Some researchers maintained that the achievement of the students is the demonstration of the students’ abilities to attain certain levels of instructional objectives outcome of classroom instruction and experience (Okwara and Upu, 2017). Once learning truly takes place it will be reflected in students’ academic achievement of that particular student as stated in the study of Yahaya, et. al., (2020) who see achievement as a quantified means that measures the student’s academic standing about those of other students' age bracket and of the same learning environment. Academic achievement from different perspectives of researchers is a key component in education of any school or institution and this is the reason why over the years, it has been a major focus of researchers and experts in education. With the use of Hausa as a medium of instruction in schools, the academic achievement of Chemistry Senior Students in Secondary Schools may yield knowledge of science in the advancement of a nation (Faruku and Corrienna, 2019).

The nature of science is dichotomous, because, it is both a body of knowledge and a process of acquiring new knowledge. In other words, science is categorized into ‘Process’ and ‘Product’ (Safaah, et. al., 2017). The ‘process’ of science is categorized into two, namely; scientific attitude and science process skills; while the ‘product’ of science are facts, concepts, principles, theories, and laws. Scientific attitude is the ability to react consistently, rationally, and objectively in certain ways to a novel or problematic situation (Olasehinde and Olatoye, 2014). Scientific attitude can also be the mindset to do things in a way that relies on proven and empirical principles rather than unverified principles. A scientific attitude is not adequate to produce a more reliable outcome without the use of science process skills (SPS). Science Process Skills are hands-on and minds-on skills that are deployed in solving scientific problems. Science process skills provide a framework for how scientists think, work, and study problems as well as seek solutions scientifically (Idiege, et. al., 2017).



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According to Safaah, et. al., (2017), science process skills are a set of skills used in conducting scientific activities and using scientific information to solve problems. Science process skills originated from a program named 'Science A Process Approach' (SAPA) introduced by the 'American Association for Advancement of Science' (AAAS) in the year 1967. The AAAS classified SPS into the basic and integrated skills, which were fifteen (15); the basic science process skills are eight (8), while the integrated science process skills are seven (7).

The basic science process skills are fundamental skills that are necessary for scientific discovery. Examples of basic science process skills are: observing, measuring, classifying, communicating, predicting, inferring, using numbers, and questioning. Integrated science process skills are higher skills that are the pillars, which are built on the existence of basic science process skills. Examples of integrated science process skills are: formulating hypotheses, experimenting, manipulating and controlling variables, interpreting data, defining operationally, formulating models, and presenting information. The basic science process skills that will be assessed in this study are: observing, measuring, classifying, communicating, inferring, and recording/using numbers (Keziah and Adamu, 2022). These science process skills will be assessed because it is captured in the senior secondary school two (SS2) Chemistry syllabus. Basic science process skills are deployed through practical experiences in science subjects, which chemistry at various ability levels. Witkin et. al. (2015) have identified three ability levels in teaching-learning situations, viz: High, medium, and low. High-ability level learners are those who prefer isolation and social distance, theoretical and abstract ideas (akin to field independent learners). According to him, high-ability individuals are better than medium or low-ability groups and might be better in other tasks that have to do with the use of hands. In this case, the high-ability group has a greater ability to structure information and solve problems. However, medium-ability level learners perform relatively better on learning activities involving social materials and are more likely to require externally defined goals and reinforcements (Witkin et. al., 2015). These ability levels of students can be found in both genders. Gender is a state of being a male or a female. The role of gender in achievement, especially in Chemistry from one study to another. Various studies, for example, Jugović (2017) and Okwara and Upu (2017), in the area of gender influence on achievement were unpredictable. Some studies favoured male students over females in Chemistry achievement, while other studies are in favour female students. With the empirical evidence about academic achievement, the study seeks to develop and validate of Hausa Practical Module for Integrating Science Process Skills Among Secondary School Students in Minna, Niger State.

Despite the increasing diversity of students in multilingual classrooms across most schools in Nigeria, the language of instruction remains a contentious issue due to the National Policy on Education (NPE) 2013. Section 1, which covers the Philosophy and Goals of Education in Nigeria under serial number 8, states that "To fully realise the goals of education in Nigeria and benefit from its contribution to the national economy, the Government shall take necessary measures to ensure that: every child shall be taught in the mother tongue or language of the immediate community for the first four years of basic education. Additionally, it is expected that every child shall learn one Nigerian language. This policy highlights the importance of the mother tongue or language in teaching and understanding core subjects like the economy, but it is limited to the first four years of basic education. However, if the use of the mother tongue or language could be incorporated into the teaching and learning of chemistry practicals, it could significantly contribute to Nigeria's economic development, given that practical chemistry enhances economic benefits. This entails developing a skilled workforce through practical chemistry, which is essential for industries, research institutions,



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and laboratories. While practical work is vital in chemistry education, it also presents challenges, such as difficulties in reading and understanding materials published in a foreign language. Furthermore, practical work demands more time and the presence of qualified and experienced teachers, as well as technical assistants. More importantly, the language used in teaching practicals can hinder some students' ability to interpret key concepts and terminology. Based on these considerations, the study aims to develop and validate a Hausa Chemistry Practical Module to integrate science process skills among secondary school students in Minna, Niger State.

Aim and objectives of the study

The main aim of this research study is to develop and validate a Hausa Chemistry practical module for integrating science process skills among secondary school students in Minna, Niger state. Specifically, the objectives of the study are to:

1. Design a Hausa Chemistry Practical Module for integrating science process skills among secondary school students in Minna, Niger state.
2. Establish the content validity of the designed Hausa Chemistry Practical Module for integrating science process skills among secondary school students in Minna, Niger state.
3. Find out the effect of the Hausa Chemistry Practical Module on Secondary School Students' Achievement in Volumetric Analysis.
4. Find out the effect of the Hausa Chemistry Practical Module on Secondary School Achievement in Volumetric Analysis based on Gender.

Research Questions

The following Research Questions were raised to guide the study:

1. What are the strategies in the development of the Hausa Chemistry Practical Module?
2. What is the established content validity of the designed Hausa Chemistry Practical Module for integrating science process skills among secondary school students in Minna, Niger state?
3. What is the effect of the Hausa Chemistry Practical Module on Secondary School Students' Achievement in Volumetric Analysis and those taught with the demonstration method?
4. What is the effect of the Hausa Chemistry Practical Module on the mean achievement scores of Male and Female students taught Volumetric Analysis?

Scope of the Study

The study was limited to Minna, Niger State, which is the state capital and has two major local government areas, Chanchaga and Bosso, respectively, located at 10°00'N and 6°00'E of the equator. The topic covered was titration in Chemistry Practical. The study was conducted in the four (4) Senior Secondary Schools, which are Chanchaga and Bosso Local Government Area of Minna. The study was delimited to SS II students of the selected Senior Secondary Schools because the topic is offered in the SS II curriculum. The variable scope is Volumetric Analysis, and the study lasted for six (6) weeks.

Research Methodology

This study utilised the design and development research approach to establish an empirical basis for the creation of the Hausa Chemistry Practical Module, which is a self-instructional module. In particular, the researcher utilised the ADDIE (Analysis, Design, Development, Implementation, Evaluation) Model in developing the Hausa Chemistry Practical Module in Volumetric Analysis, as shown in (Appendix A). while the study also utilised a quasi-experimental design (pre-test post-test non-equivalent, non-randomised, control group). The reason for adopting a quasi-experimental design is that the researcher will use intact classes in the implementation and Evaluation of the



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Hausa Chemistry Practical Module. The quasi-experimental design layout utilised is shown in Table 3.1

Table 3.1 Research Design Illustration

Groups	Pretest	Treatment	Posttest
Experimental Group	O ₁	X	O ₂
Control Group	O ₁	-	O ₂

Where:

O₁, O₁ - Pretest Scores of experimental and control groups.

O₂, O₂ - Posttest Scores of experimental and control groups.

X₁ – Treatment for the experimental group only

Population of the Study

The population of this study comprised all the Senior Secondary II Students from all the government-owned Senior Secondary Schools in Minna, the capital of Niger State. The total population was Twelve Thousand Four hundred and thirty-three (12433) (See Appendix K) students who were in SSII, although the targeted population for the study were all Senior Secondary II Students who registered for Chemistry in the 2023/2024 academic session.

Sample and Sampling Techniques

For this study, a simple random sampling technique was applied to select the four 4 schools and similarly, the same sampling technique was applied in picking Senior Secondary School Students II (SSII) intact classes used for the research exercise. The students in each of the intact classes constituted the sample size (414) used for the study. The four 4 intact classes selected for the study, two classes out of the four, were assigned as experimental and control groups randomly. The distribution of the sampling size of (414) for this study

Research Instrument

Three instruments were used for this study and were categorized as follows;

1. Treatment Instrument (Hausa Chemistry Practical Module (HCPM))
2. Test Instrument (Chemistry Practical Achievement Test (CPAT))
3. Science Process Skills Rating Instrument (SPSRI)
4. Evaluators' Rating Form (ERF)

Validation of Research Instruments

Validation of Hausa Practical Module (HPM)

To gather evidence that supported the adequacy of objectives, content, format and language, presentation, and usefulness of the Hausa Chemistry Practical Module to its intended users, expert judgments were sought by the researcher. In doing this, the first draft of the Hausa Chemistry Practical Module was printed and presented by the researcher to her supervisor and two experts on the development in the Chemistry Department, COE Minna. Then, the researcher revised the module based on the comments and suggestions of the experts who were requested to read and evaluate the modules. Afterwards, the revised HCPM was validated by 7 experts. This panel of experts consisted of one chemistry professor, three Hausa teachers, one head teacher, one college of education chemistry instructor, and one test specialist. They examined the module based on five indicators, which include: (1) objectives; (2) content; (3) format and language; (4) presentation; and (5) usefulness of the instructional module. Observations, Corrections and Suggestions of the experts were used to produce the final copy of this instrument, which was used for this study.



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Validation of Chemistry Practical Achievement Test (CPATEL) and Science Process Skills Rating (SPSREL)

The Chemistry Practical Achievement Test in English Language (CPATEL) and Science Process Skills Rating in English Language (SPSREL) were validated by three (3) experts: one in the Chemistry Department, College of Education, Minna, one Chemistry teacher from Maryam Babangida Girls Science College, Minna, and one Chemistry Teacher from Himma International School, Minna. These experts examined the face and content of the instruments. Generally, the validators' comments and suggestions were used for necessary modifications. The test items were corrected and modified according to the suggestions and comments of the experts.

Validation of Chemistry Practical Achievement Test in Hausa Language (CPATHL) and Science Process Skills in Hausa Language (SPSHL)

The Chemistry Practical Achievement Test in Hausa Language (CPATHL) and (SPSHL) were validated by three experts, one in the Hausa Department, College of Education, Minna, one in Maryam Babangida Girls Science College, and one expert in Himma International School, Minna. These experts examined the face and content of the instruments. Generally, the validators' comments and suggestions were used for necessary modifications. The test items were corrected and modified according to the suggestions and comments of the experts.

Reliability of the Research Instruments

A pilot test was conducted to determine the reliability of the test instrument, which was conducted in a different Senior Secondary School that did not constitute the sample of the study. Forty (40) (20 Male and 20 Female) students were used to obtain the reliability of the Chemistry Practical Achievement Test in English Language (CPATEL) and Chemistry Practical Achievement Test in Hausa Language (CPATHL). A Test-Retest Method was used to administer the CPATEL and CPATHL, i.e. the students were given the CPATEL and CPATHL multiple-choice items with four options A-D after one week, and the same test was re-administered to the same group of students. The results of the first test and the second were subjected to Pearson's Product-Moment Correlation Coefficient (r), and their correlation coefficient indexes of 0.89 for the CPATEL and 0.81 for the CPATHL, meaning the two instruments are reliable for the study. The SPSR obtained was subjected to the Cronbach Alpha, and it yielded a correlation coefficient index of 0.82.

Method of Data Collection

The researcher visited the four (4) sampled schools two weeks before the experiment to seek official permission from the school Management. After the permission had been granted, the researcher was introduced to both teachers and students of the selected schools. A total of 414 (241 Male and 173 Female) students were selected from the four 4 sampled schools. The technique adopted was the simple random sampling technique, which was used to select the class in each of the schools (experimental and control) for the study. Afterwards, the researcher, together with the research assistants, made arrangements on how to use the (HCPM) on the experimental groups and use a normal practical class procedure on the control group. During the first and second (1st and 2nd) weeks of the study pre-test was administered to all the groups with the help of the research assistants before the treatment to determine the knowledge equivalence of both the experimental and control groups. Thereafter, actual teaching for all the groups took place from the third to the fifth (3rd to 5th) week. Lessons on the content areas were therefore presented for three (3) weeks using a double period of eighty minutes per week. From the 6th week, there was a revision and administration of the Chemistry Practical Achievement Test (CPAT) to the two groups (experimental and control) as a post-test. The entire period for data collection lasted for six (6) weeks.



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Method of Data Analysis

A descriptive statistic specifically percentages, means and standard deviations in analyzing the evaluation ratings of experts were used to answer the stated research questions stated for this study because the data obtained were discrete in nature and also z-test and Analysis of variance (ANOVA) was used to test all the hypotheses at 0.05 significant level and the statistical tool was chosen because the data obtained from pretest and posttest scores was of discrete numerical type. A computer software Statistical Package for Social Science (SPSS) version 23.0 was used for the analysis of data obtained for the study.

Results And Discussion

This Chapter presents the relevant data for answering the research questions and for testing the hypotheses. The descriptive statistics of mean and standard deviation were used to answer the research questions, while the hypotheses were tested using the z-test statistics.

Designed Self-Learning Module

Hausa Chemistry Practical Module (HCPM) areas of Volumetric Analysis were developed and validated. Specifically, the module consisted of 6 lessons on Volumetric Analysis and is listed as follows: Volumetric Analysis; Units of Measurement; Acid-Base Titration; Acid-Base Determination of the Concentration (Standardisation) of a Solution; Acid-Base Determination of Percentage Purity of a Substance; Acid-Base Titration of a Solution of a Weak Base and A Strong Acid

The developed instructional module included the following parts: objectives, pretest, learning activities with illustrative examples, practice tasks, and posttest. The researcher ensured that the developed module has built-in statements of objectives informing students about what they should be able to learn after instruction. Furthermore, the module has the information sequenced in logical steps, and then testing (e.g. practice tasks, posttest) is undertaken to make sure that students can follow the steps.

Validation of the Developed Instructional Module

Table 1a Evaluators' Rating

Aspect of the Instructional Module	Items	Mean (\bar{x})	SD	Decision
Objectives of the Module	The objectives are clearly stated in the module's behavioural form	3.29	1.113	Good
	The objectives are well-planned, formulated, and organised.	4.15	0.691	Very Good
	The objectives stated are specific, measurable, and attainable.	3.86	1.070	Very Good
	The objectives are relevant to the topics of each lesson of the module	3.58	1.398	Very Good
	The objectives take into account the needs of the students	3.58	1.512	Very Good
	Overall	3.69	1.157	Very Good
Content of the Module	The content of each lesson is directly relevant to the defined objectives	3.00	1.155	Good
	The content of each lesson is simple and easy to understand	3.72	0.952	Very Good
	The topics of each lesson are fully discussed.	3.29	1.113	Good



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	The topics are supported by illustrative examples, and the practice tasks are suited to the level of the students	3.15	1.215	Good
	Each topic is given equal emphasis in the lesson.	3.58	1.273	Very Good
	Overall	3.35	1.142	Good
Format and Language of the Module	The format/layout is well-organised, which makes the lessons more interesting.	3.43	1.273	Good
	The language used is easy to understand.	3.58	1.134	Very Good
	The language used is clear, concise, and motivating.	3.43	0.535	Good
	The symbols used are well-defined.	3.58	1.134	Very Good
	The instructions in the instructional module are concise and easy to follow	3.86	0.691	Very Good
	Overall	3.58	0.953	Very Good
Presentation of the Module	The topics are presented in a logical and sequential order.	2.72	0.952	Good
	The lessons of the module are presented in a unique and original form.	3.29	1.254	Good
	The learning activities are presented clearly.	3.86	1.070	Very Good
	The presentation of each lesson is attractive and interesting to the students	3.29	1.254	Good
	Adequate examples are given to each topic.	3.00	1.155	Good
	Overall	3.23	1.137	Good
Usefulness of the Module	The instructional module will motivate the students to study volumetric analysis	3.58	1.273	Very Good
	The instructional modules will help the students master the topics at their own pace.	3.72	1.381	Very Good
	The instructional module will allow the students to use their time more efficiently	3.58	0.976	Very Good
	The instructional module will develop the analytical thinking and reasoning skills of students in solving problems	3.58	1.134	Very Good
	The instructional module will serve as supplementary material that can cater to the needs of the students	3.43	1.512	Good
	Overall	3.58	1.255	Very Good

Table 1b: Summary of the Evaluators' Rating based on the Aspect of the Instructional Module

Aspect of the Instructional Module	Mean (\bar{x})	SD	Decision
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Objectives of the module	3.69	1.157	Very Good
Content of the Module	3.35	1.142	Good
Format and Language of the Module	3.58	0.953	Very Good
Presentation of the Module	3.23	1.137	Good
Usefulness of the Module	3.58	1.255	Very Good
Overall	3.47	1.123	Good

In detail, all evaluators strongly agreed that the instructional module has objectives which are clearly stated in behavioural form, specific, measurable, and attainable. Also, they strongly agreed that the objectives are well-planned, formulated, organised, and relevant to the topics of each lesson of the module, and they take into account the needs of the students. Likewise, the evaluators' responses showed that they strongly agreed that the content of each lesson is directly relevant to the defined objectives, and it is easy to understand. Furthermore, all evaluators strongly agreed that the topics of each lesson are fully discussed and supported by illustrative examples and practice tasks, which are suited to the level of the students. Also, as shown in Table 1a, the variation in the form of the standard deviation of the responses is very small. With regard to the format/layout of the module, the evaluators agreed that the format/layout is well-organised. Likewise, the language used for the module is clear, concise, motivating, and easy to understand. Regarding the presentation of the instructional modules, the evaluators strongly agreed that the topics are presented in a logical and sequential order. They further agreed that the lessons of the modules are presented in a unique and original form. Lastly, looking at the evaluators' responses on the usefulness of the module, the evaluators strongly agreed that the developed instructional module will motivate the students to study Volumetric Analysis. Furthermore, they strongly agreed that the module will help the students master the topics at their own pace. Also, they strongly believed that this module would allow the students to use their time more efficiently and would cater to their needs.

Answering Research Questions

What is the effect of the Hausa Chemistry Practical Module on Secondary School Students' Achievement in Volumetric Analysis, and those taught with the demonstration method? The descriptive statistics of mean and standard deviation were used to answer this research question, and a summary of the results is presented in Table 2

Table 2 shows the descriptive statistics of the mean and standard deviation of students' scores of experimental and control groups at the pre-test and post-test.

Groups	N	Pre-test		Post-test		Mean Difference
		\bar{x}	SD	\bar{x}	SD	
Experimental	192	5.03	1.989	13.70	3.281	8.67
Control	222	5.09	2.005	10.33	2.938	5.24

The data presented in Table 2 shows that the experimental group had a mean score of 5.03 and a standard deviation of 1.989 in the Pre-test and a mean score of 13.70 and a standard deviation of 3.281 in the Post-test, resulting in a Pre-test and Post-test difference in the experimental group to be 8.67. The control group had a mean score of 5.09 and a standard deviation of 2.005 in the pre-test and a post-test mean score of 10.33 and a standard deviation of 2.938, with a pre-test post-test



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difference of 5.24 in the control group. With this result, the students in the experimental group performed better in the achievement test than the students in the control group.

What is the effect of the Hausa Chemistry Practical Module on the mean achievement scores of Male and Female students taught Volumetric Analysis? The descriptive statistics of mean and standard deviation were used to answer this research question, and a summary of the results is presented in Table 3

Table 3: Means and Standard Deviation of Achievement Mean Score Male and Female Groups of Students Taught Volumetric Analysis Using HCPM

Groups	N	Pre-test		Post-test		Mean Difference
		\bar{x}	SD	\bar{x}	SD	
Male	119	4.98	1.979	13.71	3.355	8.98
Female	73	5.11	2.018	13.68	3.179	8.57

Results in Table 3 show that the male group had a mean score of 4.98 and a standard deviation of 1.979 in the pre-test and a mean score of 13.71 and a standard deviation of 3.355 in the post-test, resulting in a pre-test and post-test score difference in the male group to be 8.98. On the other hand, the female group had a mean score of 5.11 and a standard deviation of 2.018 in the pre-test and a mean score of 13.68 and a standard deviation of 3.179 in the post-test making a pre-test and post-test difference of 8.57 The results show that there is a difference between the mean achievement scores of male and female students when taught Volumetric Analysis Using HCPM in favour of the male students.

Conclusion

The study investigated the effects of the development and validation of a Hausa chemistry practical module for integrating science process skills among secondary school students in Minna, Niger state. Seven objectives and corresponding research questions, as well as four research hypotheses, were formulated and have guided the study. The study used Chemistry Practical Achievement Test in English Language (CPATEL, Chemistry Practical Achievement Test in Hausa Language (CPATHL, and Science Process Skills Rating (SPSR) as test instruments. On the other hand, it used Hausa and English versions Volumetric Analysis Modules as the treatment modules. The participants were assigned to the Hausa group and the English group, and a control group was also established. Students were taught and tested, and the data collected were analysed using descriptive statistics and inferential statistics (mean, standard deviation, Z-test). The result established better achievement and higher science process skills among the Hausa version taught group. It was therefore concluded that: Hausa volumetric module is an effective medium of instruction in chemistry as it enhances students' achievement in chemistry. Moreover, Hausa volumetric module is a gender friendly module that can be used in secondary school chemistry practical class learning.

Recommendations

Align with the Recommendation of Federal University of Technology, Minna and Department of Science Education to conduct research in marketable areas and in award-winning research, the researcher recommends the following for future studies:

1. The developed instructional modules can be used to complement the teaching of Volumetric Analysis in the class
2. The federal government of Nigeria should encourage the use of the mother tongue in the teaching and learning of chemistry and other science subjects in secondary schools, as practised by some countries.



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