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Research Paper

Effect of Hands-on Activity Learning Strategy (HALS)on Students' Achievement and Interest in Chemistryin Delta State

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Abstract
The study assessed HALS's effect on chemistry achievement and interest in Delta State.Pretest, posttest, control group design was employed. The population comprised 18,879 SSII chemistry students from Delta State's public secondary schools. The study's sample consisted of two hundred twenty-three (223) SSII chemistry students. Chemistry Achievement Test (CAT) and the Chemistry Interest Scale (CIS) were utilized to collect data. CAT and CIS have a reliability of 0.77 and 0.81, respectively. Means, standard deviations and t-test were used to analyze the gathered data. Results demonstrated a substantial difference between students taught with HALS and lecture method (LM) in terms of mean accomplishment and interest scores, favouring HALS; and the chemistry mean achievement and interest scores of males and females taught with HALS did not significantly differ.It concludes that HLS is a superior strategy compared to LM, for increasing students' chemistry achievement and enthusiasm. It was suggested that chemistry teachers at the senior secondary level employ HALS to teach chemical principles.

Keywords: ***HALS, academic achievement, interest***

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I. Introduction

Chemistry is the study of matter in its most basic form. Chemistry is a science that examines the elements that make up matter, its structure, and the forces that keep things together. Students who want to work in the fields of medical, pharmacy, dentistry, food science, agriculture, engineering, scientific teaching, environmental science, and other fields should consider taking chemistry (Igbonugo, 2015). The study of chemistry as a discipline is extremely important to humanity, because its principles have aided modern advancements. Chemistry is vital for a growing country like Nigeria to boost the development of scientifically educated citizens, in order, to advance to the level of developed countries. The attainment of this objective subjected to various factors, especially, the approach teachers of chemistry use to educate citizens.

In Nigerian secondary schools, the lecture method (LM) has been the predominant mode of instruction. This method involves frequently repeating facts and activities to help learners understand the content. The technique promotes lesson note completion on schedule, but it pushes students to memorise and repeat lessons instead of understanding and internalising them. According to Ajaja (2013), LM is a "talk-chalk" method. The author also said that the LM can be used for classes of any size, although it is typically utilized for big classes. In LM, the teacher is seen as the expert and students are expected to contribute little to nothing to the learning

process.Perhaps this explains the frequently low academic performance on public examinations. Consequently, it is important to seek out a suitable strategy for teaching chemistry in schools.

This study focused on the hands-on activity learning strategy (HALS) since it is thought to provide students with more meaningful learning experiences. Learning via experience, learning by doing, learning through action, and learning through exploration and discovery are all terms used to describe HALS. Agsalog (2019) argued that for education to be progressive, the lesson must incorporate experiential learning. HALS is a teaching strategy that enables students to learn through hands-on experience, reflect on those experiences, and turn them into practical knowledge that can be applied to daily life. A venue for HALS can be created in the classroom or lab through embedded activities, problem-based studies, guided inquiry exercises, demonstrations, and creative endeavours (Wurdinger & Carlson, 2010). HALS encourages a range of activities so that students can ponderexpand their knowledge and put what they've learned to use by tackling new issues in their daily lives. It involves learning, which depends on fundamental skills, and acquiring or employing more sophisticated skills. It is possible to incorporate extracurricular learning experiences and activities into the teaching-learning process. When learning tasks are converted into products that comprise the information and skills acquired from these activities and experiences, these activities and experiences are finally represented in those products.

Academic success is what a student is able to acquire through successful completion of coursework. It is the work that a student completes in the classroom, lab, or field while attending school. Usually, It speaks of the degree of accomplishmentor level of skill attained in academic work (Arora, 2016). It encourages students to put forth more effort and learn more. It is the state of a student's learning and pertains to the knowledge and abilities they have acquired throughout their academic career. School authorities evaluate it using teacher-created or standardised tests. HALS is thought to have the power to improve students' achievement and interest.

Interest is simply the urge to learn something, to put it simply. It refers to the feeling of being intrigued or worried regards a subject. It is a motivating factor in the teaching and learning process (Ebiguvwere, 2018). The author said that a student's level of interest can be measured by conducting a talk with him or her and monitoring some of his or her actions. Interest is a vital component of teaching and learning. It is normal for students to prioritise certain learning opportunities over others to avoid topics that do not pique their interest. A teacher must evaluate the interests of his or her students in order to design and choose appropriate activities for class objectives. When learning experiences are centred on the learner's interests, they are more meaningful and engaging. Regardless of gender, the use of an effective teaching approach may increase students' engagement during education.

In Nigerian culture, gender differentiation is a critical issue. Male students are regarded to achieve higher levels of success than females. However, the literature study revealed that there is no consensus on the superiority of male students in chemistry over their female counterparts. In this study, the adoption of HALS is projected to have the same kind of influence on males and females'achievement and interest in chemistry. In consideration of this, the researchexplored theeffect of HALS on chemistry achievement and interest in Delta State.

Statement of the Problem

Science students at Senior School level in Nigeria, enroll chemistry yearly, in West African Examination Council (WAEC) examinations. A review of West African Examination Council (WAEC) Chief Examiner's reports (2015-2019) has shown that the increased yearly enrolment in chemistry is accompanied by outrageous poor performance. Chemistry students' poor performance may be attributed to various factors including poor teaching methods. It is believed that LM widely used in Nigerian Secondary Schools has made students to resort to memorization of chemistry concepts because of their non-active involvement during teaching and learning. The students in the LM classroom are not given the opportunity to manipulate discrete objects through experimentation in order to make conclusions from their experience with these concrete objects. The students are not given the opportunity to discover facts on their own. This calls for the adoption of alternative teaching methods that have the potential of providing opportunity for students to seek information using experimental procedures. It is believed that HALS ensures students active involvement during instruction and students are involved in various hands-on-activities during instruction. Therefore, will the use of HALSenhancethestudents' chemistry achievement and interest than LM?

Purpose of the Study

This study assessed HALS's effect on the achievement and interest among chemistry students. Specifically,compared:

1. themean achievement scores of chemistry students taught with HALS and LM;
2. the mean interest scores of chemistry students taught with HALS and LM.
3. the mean achievement scores of male and female chemistry students taught with HALS;
4. the mean interest scores of male and female chemistry students taught using HALS.

Hypotheses

This study was guided by four hypotheses that were tested at a significance level of 0.05.

1. The mean achievement scores of students taught chemistry using HALS and LM is not significantly different.
2. There is no statistically significant difference between the mean interest scores of students taught chemistry using HALS and LM.
3. There is no significant difference between the chemistry mean achievement scores of males and femalestaught with HALS.
4. There is no statistically significant difference between the chemistry mean interest levels of males and females taught with HALS.

II. Methodology

The research utilized pretest, posttest control group design. It included experimental and control groups instructed with HALS and LM, respectively. The study included 18,879 SSII students offering chemistry. 223 SSII students participated in the research. Chemistry Achievement Test (CAT) and Chemistry Interest Scale (CIS) was used to collect data. The CAT and CIS's reliability was ascertained the Kuder-Richardson formula 21 and Cronbach Alpha. This was accomplished by delivering the CAT and CIS to forty SSII chemistry students outside the study area and calculating their reliability indices. The reliability value for CAT was shown to be 0.77, whereas that for BIS was 0.81. Before and after treatment, CAT and CIS were used as a pre- and post-test, respectively.The pre-test was performed to determine the group's equivalence.Mean, standard deviation and the t-test were used to assess the data that had been obtained, since the pre-test scores did not differ substantially.

III. Results

✓ There is no significant difference between the chemistry mean achievement scores of students taught with HALS and LM.

Table 1

Comparison of Chemistry Posttest Scores of Students Taught with HALS and LM

Group	N	$\bar{x}$	SD	df	t-cal.	Sig. (2-tailed)	Decision
Hands-on learning	120	66.88	9.26	221	9.530	0.000	Ho_1 is rejected
Lecture method	103	55.65	8.18				

The mean levels of academic success on students' post-teststaught with HALS and LM differ significantly, t = 9.530, P <0.05.Consequently, a statistically significant difference exists between the mean accomplishment scores of students taught chemistry with HALS and LM, in favour of HALS.

✓ There is no statistically significant difference between the mean interest scores of students taught chemistry using HALS and LM.

Table 2

Comparison of Chemistry Posttest Scores of Students Taught with HALS and LM

Group	N	$\bar{x}$	SD	df	t-cal.	Sig. (2-tailed)	Decision
Hands-on learning	120	71.20	8.14	221	9.436	0.000	Ho_2 is rejected
LM	103	60.31	9.09				

The posttest mean interest scores of students taught chemistry with HALS and those taught with LM differ significantly, t = 9.436, P <0.05. Consequently, there is a statistically significant difference between the mean interest scores of students taught chemistry with HALS and LM, in favour of HALS.

✓ There is no statistically significant difference between the chemistry mean achievement scores of males and femalestaught with HALS.

Table 3

Comparison of Chemistry Posttest Mean Achievement Scores of Males and Females Taught withHALS

Sex	N	$\bar{x}$	SD	df	t-cal.	Sig. (2-tailed)	Decision
Male	58	68.28	10.07	118	1.604	0.111	Ho_3 is not rejected
Female	62	65.58	8.30				

The posttest chemistry average achievement scores of males and femalesexposed to HALS differ insignificantly, t = 0.604, P > 0.05. Therefore, insignificant difference between the chemistry mean achievement scores of males and femalesexposed to HALS.

✓ There is no statistically significant difference between the chemistry mean interest levels of males and females taught with HALS.

Table 4

Comparison of Chemistry Posttest Mean Interest Scores of Males and FemalesTaught withHALS

Sex	N	$\bar{x}$	SD	df	t-cal.	Sig. (2-tailed)	Decision
Male	58	70.97	7.93	118	0.304	0.762	Ho_4 is not rejected
Female	62	71.42	8.40				

The posttest chemistry averageinterest scores of males and females taught with differ insignificantly, t = 0.304, P > 0.05. Thus, the chemistry mean interest scores of males and females taught HALS differs insignificantly.

IV. Discussion

The study indicated a significant difference between the chemistry mean achievement scores of students taught with HALS and LM, in favour of HALS. Students' participation during instruction may account for differences in accomplishment scores between groups. During the teaching and learning process, students in the HALS group actively discovered knowledge on their own with minimal assistance from the instructor by engaging in a range of hands-on activities that facilitate concept conceptualization. Students in the LM group, however, relied completely on the information provided by the teacher. In other words, the LM group students were not engaged during instruction. This may have contributed to the low achievement results of LM-taught students. This finding aligns with that of Agsalog (2019) that reported a substantial difference in the students' performance taught using HALS and LM. Studentsthat were taught utilising HALS had meaningful and substantial learning experiences.

The study also demonstrated a large accomplishment gap in terms of students' interest in chemistry taught with HALS and LM, favouring HALS. One probable explanation for this result is that HALS captivate and engage students' attention by promoting critical thinking rather than rote memory, so fostering the development of deep, meaningful knowledge. HALS encourages self-discovery of information through a range of manipulative exercises. Students using HALS to learn chemistry find facts independently. This may have increased their enthusiasm for chemistry. This result contradicts Nwaodo and Oluwatimilehin's (2020) conclusion that non-significant difference exists between the chemistry mean interest scores of students taught basic technology using the greeno problem-solving technique and LM.

In addition, the study found insignificant difference between males and females chemistry achievement scores taught utilising HALS. This implies that HALS boost the chemistry achievement of males and females equally. This finding of the study may be attributable to the fact that HALS ensures the active engagement of all students during the teaching and learning process. In other words, HALS ensured the active engagement of both sexes. This finding concurs with that of Mahmud, Usman, Olorukooba and Bichi (2016), who reported no gender difference in achievement among students who were taught chemistry using the problem-solving method.

Again, the study found non-significant difference between the chemistry mean interest levels of males and females taught with HALS. This indicates that HALS increases the chemistry interest scores of both sexes equally. The non-significance of the difference in the mean interest scores of males and females can be attributed to the fact that HALS equally awaken, stimulate and maintain male and female students' interest during instruction. The insignificantmean interest scores difference between males and females may also be attributable to the fact that both sexes paid similar attention during instruction with HALS.

V. Conclusion

Based on the study's findings, HALS is a better strategy than LM for boosting chemistry students' achievement and interest. HALS benefits both sexesachievement and interest.

VI. Recommendations

In view of the findings of this study, the followings are recommended:

1. Teachers of chemistryought to use HALS to teach at senior schools.
2. School administrators ought to provide enriching learning environment in secondary schools to enhance the implementation of HALS.
3. School administrators and other education stakeholders should organise in-service training for teachers to inform them of the significance of HALS and other active learning techniques.
4. School administrators should provide adequate laboratory facilities to schools to enhance students' discovery of facts on their own.

5. Chemistry teachers should help students to develop investigative skills to enable them to discover facts on their own.

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