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# Integration of Indigenous Knowledge into Case-Based Learning and Its Effect on Students' Interest in Organic Chemistry in Ondo State

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## ABSTRACT

Inadequate understanding of fundamental ideas in Organic chemistry can cause students to develop low interest. There are indications that indigenous knowledge and case-based Learning have the tendencies to improve student Interest in Chemistry. This study explored the impact of integrating indigenous knowledge with case-based Learning on student interest in organic chemistry among Senior Secondary School students in Ondo State, Nigeria. This study also examined the Moderating effect of gender. The study is anchored on Vygotsky's Theory of Social Constructivism. Two hypotheses at a significant level of $P > 0.05$ were tested. Four public secondary schools were randomly selected out of the existing secondary schools in Ondo West L.G. in Ondo State, and four intact classes of Senior Secondary Class 3 (SS3) Chemistry students were enlisted for the study using Criterion sampling technique. Validated instrument for the study involve Student Interest in Organic Chemistry Scale, (SIOCS), 110 students which include 45 male and 65 female students were involved in the study. A simple random sampling technique was used to assign groups into the control and experimental groups. The treatment lasted for six weeks. After six weeks, a post-test was administered and data was analyzed using descriptive statistics and analysis of covariance (ANCOVA) at $\alpha = 0.05$, mean, frequency count, mean, standard deviation, and percentage. The conventional group has the highest mean (M= 11.01) why those exposed to hybrid CBL (M=10.19). The result shows that the mean difference between hybrid case-based learning and the conventional was statically insignificant. In addition, male students have the highest mean achievement (10.874) while female students have the lowest mean achievement (10.335). Analysis of the result showed that there was no significant main effect of treatment on students' interest in Chemistry ($F_{(1;\ 109)} = 3.63$; $p>0.05$). Though the result of the treatment was insignificant, application of this innovative method would make the teacher think beyond the traditional way of teaching. Therefore, Chemistry teacher should be trained on how to use and explore the method as a new method of teaching chemistry. More research will be needed to be carried out on this innovative pedagogy to improve student's interest in chemistry.

**KEYWORDS:** Indigenous Knowledge, Case-Based Learning, Organic Chemistry, Ondo State

## I. INTRODUCTION

Chemistry is the nucleus of all the physical sciences as it is the centre of man's existence and survival. It is applied in the areas of food and agriculture, manufacturing industries, health and pharmaceuticals, power, works, oil and gas, textile, water treatment, and engineering. Among the different branches of Chemistry is Organic Chemistry. Organic chemistry is fundamental to many everyday products and industries, from food and beverages to soaps, medicines, and



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cosmetics. Despite their practical relevance, students often find organic chemistry abstract and difficult which consequently reduces interest (Ahmad & Halliru, 2022). Traditional teaching approaches, often rooted in Western-style instruction and divorced from students' lived experiences, have been repeatedly shown to result in limited student engagement and disinterest. Different strategies have also been employed to improve student interest in organic chemistry but little has been achieved. Such strategies include cooperative and individualized teaching methods (Olatoye et al 2011, Udu 2018), individualized computer-based instructional and modified conventional strategy (Abimbade et al 2017), jigsaw cooperative method (Oliveira et al 2019), mind mapping strategy (Liu 2021), not much has been achieved. Perhaps, a more interactive, innovative, and learner-friendly teaching strategy such as the infusion of indigenous knowledge into case-based Learning should be recommended as a constructivist approach to deepening conceptual understanding and improving students' interest in organic chemistry.

Interest is a mixture of curiosity, attention, and willingness to engage with a subject over time. Interest matters because it drives students to invest effort, ask questions, and persist when ideas are challenging (Mavuru & Ramnarain, 2020). In organic chemistry, where students must grasp symbolic representations and mechanistic thinking, strengthening interest can reduce reliance on rote memorization and encourage deeper understanding. Indigenous Knowledge includes community-rooted practices and explanations passed down through generations. In many cultural contexts, traditional activities such as food fermentation and local soap making embody clear organic chemical processes. When instructors use these familiar activities as teaching resources, they make the abstract content concrete and culturally relevant (Ahmad & Halliru, 2022; Mavuru & Ramnarain, 2020). Case-Based Learning is an active, student-centered approach in which learners investigate real scenarios to solve problems and apply theory. CBL gives students a narrative and a purpose for learning: rather than memorizing reaction steps, students explore why a traditional fermentation yields a certain flavour or how a local soap-making recipe affects soap hardness and lather.

Integration of indigenous knowledge with case-based learning (IK-CBL) in science classrooms is grounded in the sociocultural theory of learning, which posits that knowledge is socially constructed, and learning is more meaningful when it is connected to learners' social and cultural worlds (Simataa & Ngcoza, 2024). Focusing specifically on fermentation and saponification brings additional advantages. Fermentation connects with food culture, nutrition, and entrepreneurship, making it easy for students to observe and discuss chemical changes. In essence, indigenous knowledge can become a contextual scaffold within CBL, allowing students to formulate meaning, situate scientific concepts in real-world scenarios familiar to them, and thereby increase their interest in subjects like organic chemistry (Zidny & Eilks, 2020). This approach aligns closely with culturally responsive pedagogy, which state that bringing students' cultural experiences into the learning process promotes belonging, relevance, and academic success and can therefore enhance interest.

In spite the available empirical rationale for integrating indigenous knowledge into Chemistry education, there is no research on how indigenous knowledge can be integrated specifically into case-based learning in order to measure its affects on students' interest in organic chemistry among secondary schools in Ondo West Local Government Area, Ondo State, Nigeria. While general studies have explored the integration of Indigenous Knowledge (IK) into science education (Simataa & Ngcoza, 2024), and other research has investigated the role of culturally contextualized instruction in chemistry learning (Zidny & Eilks, 2020), no study have combined IK with case-based learning strategies to examine their effect on students' interest in organic chemistry. Furthermore, most of the existing studies focus on either curriculum development,



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teacher perceptions, or student achievement in broad science subjects, with little attention to organic chemistry as a discrete domain that remain challenging for students. There is, therefore, a pressing need to empirically investigate how integrating indigenous knowledge into contextually rich case scenarios of fermentation and saponification can affects students' interest in organic chemistry, especially in culturally diverse learning environments such as Ondo West Local Government. Addressing this gap has the potential not only to enrich pedagogical practice but also to contribute to wider discussions around culturally responsive science education in Nigeria. This study which focus on fermentation and saponification, therefore aims to show how the integration of culturally responsive, problem-centered instruction into case-based Learning pedagogy can affect students' interest in organic chemistry.

## II. RELATED WORKS

Education is an important process in human civilization and development. It is the total process of human learning by which knowledge is impacted, human faculties are trained and various skills are developed (Adesemowo and Sotonade, 2022). Education is therefore seen as the reproductive system of society. The desirable development of every nation and culture can only be achieved through a well-structured and directed education system. This desirable change can be achieved through well-articulated sciences and technology. At the centre of this desirable society change through science and Technology is Chemistry. Chemistry is the building block of science and is fundamental to the understanding of other branches of science. The fundamental knowledge required for understanding scientific principles is anchored on Chemistry as an important branch of science. The knowledge of chemistry in today's world is vital for national development as it cuts across every aspect of human endeavour. Chemistry is necessary for the economy and to improve prosperity and welfare in the world, (Ingo et al, 2016). As stated in the National Science Curriculum for Senior Secondary Schools (2013), Chemistry knowledge positions learners to take advantage of the numerous career opportunities available in the field of science.

Chemistry is offered in Nigeria Senior Secondary School as a science subject that involves both a theoretical and practical approach. It is one of the prerequisite subjects needed to study any physical science-related courses such as Medicine, Biochemistry, Nursing, and Engineering in any Nigerian university. The knowledge of chemistry helps Learners to develop a reasonable level of competence in ICT application that will engender entrepreneurship skills. Chemistry as a practical-oriented discipline helps in the development of manipulative skills in learners. It enables them to think critically and rationally and strengthen their decision-making process. In addition students also ‘’develop and exhibit skills such as inquiry, critical thinking, objectivity, rational reasoning, experimenting, logical deductions, logical reasoning among others. As important as it is, students have shown difficulties in understanding Organic chemistry which have resultantly brought about low interest. There exists a notion that the problem associated with learning chemistry at various levels of education is the abstract nature of most chemical concepts. Katarina (2020) in her research found out that students perceive organic chemistry as abstract, difficult to understand, and more difficult to learn than general and inorganic chemistry. Akkuzu and Uyulgan, (2016), in their epistemological inquiry into Organic chemistry, found out that the students generally had low interests and low level of understanding of concepts relating to functional groups of which alkanols and alkanoic acids are involved.

One of the objectives of chemistry curriculum is promoting and enhancing student interest in chemistry. Students' interest in organic chemistry has to do with students' feeling, enthusiasm, readiness, and positive attitude towards it. According to Egolum et al (2021), interest is a feeling


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which students have for any task that is appealing, valuable and beneficial to them; it occurs as a result of influence due to personal importance and capacity. . Interest is a driven force which propels students to be attracted towards a certain class activity; similarly, interest can propel students towards organic chemistry. It is the desire to learn chemistry and the willingness to participate in chemistry activities and master chemistry concepts and skills. In the context of organic chemistry, "interest" refers to the level of enthusiasm, curiosity, or fascination that individuals have for the study of organic compounds, reactions, and related principles. A high level of interest in organic chemistry can lead to greater dedication to learning, research, and problem-solving within the field. Student interest in chemistry can be influenced by many factors. Some of the factors that affect the interest of students in chemistry include teachers factor and teaching pedagogy. Student interest in chemistry is an important affective factor because it can significantly affect student achievement. Students who show interest in chemistry are likely to perform well in class activities and complete tasks or assignments. Such student is likely to pursue a career in a chemistry-related discipline. This implies that students will show more interest in organic chemistry when they have the opportunity to communicate effectively and interact during the learning process. If interest is crucial to understanding organic chemistry, then there is therefore the need to capture and maintain the interest of students in learning and organic chemistry. In line with Apuh, (2020), among the factors that can affect students' interest in organic chemistry, method of teaching is prevalent. Therefore, to improve students' maintain their interest in organic Chemistry emphasis should be laid on the methods that can be used in teaching it.

Methods of teaching chemistry are strategies and methodologies used by teachers in guiding the students to learn, (Attah, 2014). Therefore, the methods of teaching organic chemistry are strategies or the techniques that the teacher adopts which can either increase or reduce students' interest in chemistry. Instructional strategy plays a major role in effectively and efficiently interacting within the classroom environment to bring about quality learning of the subject matter among the students; therefore, the method of teaching organic reaction is very crucial in enhancing the students' interest in chemistry. The Conventional lecture method of teaching chemistry is believed to be teacher-centred and rigid. Some researchers believe that it does not encourage adequate active participation of the students during the learning process. As stated by Adesoji et al (2017) the incapacity to comprehend chemical principles leads pupils to resort to the practice of rote learning. Critical thinking capabilities are not adequately promoted among the students as they spend more time writing notes and practically looking at the teacher during classroom instruction. Several scholars and researchers have attempted to teach students the concept of organic chemistry using strategies different from conventional teaching strategies but limited results have been obtained as most of this strategy does not increase student interest in Organic hemistry. Therefore, there is a need to improve student interest in organic chemistry by testing an innovative strategy that have the tendency of improving student interest.

One of the innovative teaching methods of teaching chemistry in the 21$^{st}$ century is the incorporation of indigenous knowledge into Case-Based Learning (CBL). Case-based learning, is an active Learning strategy built on the constructivism theory of learning (Idika 2021). In this strategy, the primary emphasis is on the student, who is considered the focal point of the learning setting, aiming to foster community-oriented, student-centered, and context-specific investigation. On the other hand, Indigenous knowledge can be referred to as a complete body of knowledge, know-how, and practices maintained and developed by people in rural areas, who have extended histories of interaction with the natural environment. It can be a valuable resource for teaching and learning in a variety of disciplines including chemistry. According to Ugwu


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(2016), when well incorporated, it can be a valuable resource for teaching and learning in a variety of disciplines including chemistry. Olotu and Ugwuanyi (2017) observed that it is essential for educators to understand the fundamental and culturally–based world views that students bring to the classroom and how these views are supported by students' culture. They recommended the incorporation of indigenous techniques that stem from the Cultural Legacy of the people into science instruction. It is believed that integrating indigenous knowledge into case-based Learning will usher in a new innovative teaching pedagogy that will create a more interesting atmosphere for the students and improve Science Education.

## III. METHODOLOGY

A quasi-experimental, pretest-posttest control group design with mixed methods were adopted. Each group were treated with 20 - item closed –ended questionnaire. Guided by two Hypothesis, the population of the study involves the SS3 students in Ondo west LGA of Ondo state. A purposive sampling method was used to select four schools for the study while a simple random involving (110 SS3 Students) sampling was used for the group assignment. The sample population involves a total of 110 SS3. The research which was carried out in 6 weeks involve fermentation and saponification concepts in Organic Chemistry. A two-day orientation program was designed for the Research assistants who implemented the Strategy. Evaluation Sheet for Research Assistant (ESRA) was used to assess the level of research assistants' ability to use the infused case-based learning strategy and their mastery of indigenous knowledge. The instrument involves adapted 20 items Student Interest closed-ended questionnaire. Content validity involving expert in Chemistry education and ethno-Science experts was carried out to review the questionnaire and case content. The instruments were administered to 35 students who were not part of the study area and their responses were analyzed to estimate the instrument's reliability using Kuder- Richardson formula-20 (KR20) and the reliability result was found to be 0.81 at 0.05 level of significant.

The Data collection procedure of the six weeks research involves

(a). Seeking consent from the cooperating Schools
(b). Pretest administration of Interest questionnaire
(c). Research assistant training and distribution of materials
(d). Implementation of the strategy
(e). Posttest administration of interest questionnaire

The data collected were analyzed using both descriptive and inferential statistics.

## IV. RESULTS AND DISCUSSION

**$H_o1$:** There is no significant main effect of treatment (integration of indigenous knowledge and practices into case base learning) on students' interest in Chemistry.

The result of the analysis shows there is no significant main effect of treatment (integration of indigenous knowledge and practices into case-based learning) on students' interest in chemistry. This implies that the treatment (integration of indigenous knowledge and practices into case-based learning) did not significantly affect students' interest in chemistry and is not sensitive to students' interest in Organic Chemistry. This can imply that there is a disconnection between the story in case-based learning and the subject matter which eventually affects students' interest in chemistry. This result agrees with Tayyaba et al (2017) who asserted that the student's interest in chemistry was not high because of certain factors such as pedagogical method and it shows that pedagogical practice plays an important role in determining student interest in chemistry. Similarly, Aniodoh & Eze, (2014) claimed that lack of interest has resulted in poor achievement



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due to inappropriate and uninspiring teaching techniques used by teachers for years. This finding is contrary to Krain, M. (2016), Ugwu, A. N. (2020), and Idika, M. I. (2021) who are of the opinion that CBL when not integrated with other strategy improve student interest. This pedagogy does not significantly improve student interest in chemistry probably because it is a new approach that will require more planning for better implementation. At the same time, the students might find it difficult to relate the concepts to the story. The teachers' inadequate mastery of this new pedagogy might also constitute a challenge.

**Table 1.** Analysis of Covariance (ANCOVA) of Post-Interest by Treatment and Gender

| Dependent Variable: Interest | | | | | | |
|---|---|---|---|---|---|---|
| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
| | | | | | | |
| Corrected Model | 514.456a | 4 | 128.614 | 1.763 | .142 | .063 |
| Intercept | 6716.522 | 1 | 6716.522 | 92.044 | .000 | .467 |
| PreInterest | 405.657 | 1 | 405.657 | 5.559 | .020 | .050 |
| Treatment | 73.783 | 1 | 73.783 | 1.011 | .317 | .010 |
| Gender | 34.194 | 1 | 34.194 | .469 | .495 | .004 |
| Treatment * Gender | 56.798 | 1 | 56.798 | .778 | .380 | .007 |
| Error | 7661.916 | 105 | 72.971 | | | |
| Total | 455287.000 | 110 | | | | |
| Corrected Total | 8176.373 | 109 | | | | |
| a. R Squared = .063 (Adjusted R Squared = .027) | | | | | | |

Table 2 indicated that students exposed to in the infused Case-based Learning Strategy (CBLS) treatment group had the higher adjusted mean score in post-interest in chemistry (64.39) as against those in the Conventional Strategy (CS) control group (62.35). However, this difference in their mean scores was not statistically significant.

**Table 2:** Estimated Marginal Means for Interest by Treatment and Control Groups

| Dependent Variable: Interest | | | | |
|---|---|---|---|---|
| Treatment | Mean | Std. Error | 95% Confidence Interval | |
| | | | Lower Bound | Upper Bound |
| Conventional Strategy (CS) | 62.354a | 1.518 | 59.344 | 65.365 |
| Case-based Learning Strategy (CbLS) | 64.393a | 1.121 | 62.170 | 66.615 |

Covariates appearing in the model are evaluated at the following values: PreInterest = 57.8909.

**HO2:** There is no significant main effect of gender on students' interest in chemistry.

Table 3 indicated that the main effect of treatment (integration of indigenous knowledge and practices into case-based learning) on students' Gender in chemistry was not significant (F(1;



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109) = 1.01; p>0.05). This means that the integration of indigenous knowledge and practices into case-based learning is not gender biased. Thus, hypothesis 2 was not rejected. This finding is supported by Ajayi, V. O. (2017) who established that there is no significant difference between the mean interest scores between male and female students taught organic chemistry. This result of this finding is also corroborated by Alebiose, K. A. (2006) who shows that there is no gender disparity among the students in their interest in organic chemistry. This result contradicts the work of Glory, G. E., & Ihenko, S. (2017), who revealed that gender has a significant influence on the interest of the students. Although, in order to determine which of the treatment group have better post chemistry interest mean score, the estimated marginal means of the groups was carried out and the result is presented in Table 4.

**Table 3:** Analysis of Covariance (ANCOVA) of Post-Interest by Treatment and Gender

| Dependent Variable: Interest | | | | | | |
|---|---|---|---|---|---|---|
| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
| | | | | | | |
| Corrected Model | 514.456a | 4 | 128.614 | 1.763 | .142 | .063 |
| Intercept | 6716.522 | 1 | 6716.522 | 92.044 | .000 | .467 |
| PreInterest | 405.657 | 1 | 405.657 | 5.559 | .020 | .050 |
| Treatment | 73.783 | 1 | 73.783 | 1.011 | .317 | .010 |
| Gender | 34.194 | 1 | 34.194 | .469 | .495 | .004 |
| Treatment * Gender | 56.798 | 1 | 56.798 | .778 | .380 | .007 |
| Error | 7661.916 | 105 | 72.971 | | | |
| Total | 455287.000 | 110 | | | | |
| Corrected Total | 8176.373 | 109 | | | | |
| a. R Squared = .063 (Adjusted R Squared = .027) | | | | | | |

**Table 4:** Estimated Marginal Means for Interest by Treatment and Control groups

| Treatment | Gender | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| Conventional Strategy (CS) | Male | 62.534a | 2.175 | 58.222 | 66.845 |
| | Female | 62.175a | 1.936 | 58.337 | 66.013 |
| Case-based Learning Strategy (CbLS) | Male | 63.030a | 1.624 | 59.809 | 66.250 |
| | Female | 65.755a | 1.433 | 62.914 | 68.597 |
| Covariates appearing in the model are evaluated at the following values: Interest = 57.8909. | | | | | |

## V. CONCLUSION

This study which investigates the effect of integrating indigenous Knowledge into Case-Based Learning and its effects on Student Interest in Organic Chemistry shows that the innovative pedagogy has no significant effect on student's interest in organic chemistry. Analysis of the collected data also shows that the treatment is not gender biased. This implies that the


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methodology promotes equitable learning opportunity for all students regardless of gender. This supports inclusive classroom practices that enhance overall student engagement and outcomes. Using this approach, classroom instruction can prioritize other factors such as content mastery without concern for a decline in student's interest. This study offers a new direction of integrating Indigenous knowledge into science teaching. Further research should be carried out on this innovating teaching methodology as it has the potential of improving student's interest in Organic Chemistry. Students should be encouraged to know the traditional and cultural practices of their community or society. Teachers should be trained on the use of pedagogy that shows connections between the learned Chemical concepts and students' cultural realities.

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