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ORIGINAL ARTICLE

Science Teachers' use of Analogies in Secondary School Classrooms in Ilorin, Nigeria

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ABSTRACT

Analogies are useful tools for teaching difficult scientific concepts and clearing up learners' misconceptions. However, if not properly used, they can lead to further misconceptions. More importantly, little is known about how science teachers use analogies in Nigerian classrooms. This study assessed science teachers' use of analogies by identifying their common practices in secondary school classrooms in Ilorin, Nigeria. The sample comprised 80 science teachers obtained across 34 secondary schools using the convenience sampling technique. A researcher-designed questionnaire was used for gathering data. Frequency, percentages, and mean were used to describe the responses, while Analysis of Variance (ANOVA) was used to test the null hypothesis at a 5% level of significance. The findings revealed that the science teachers were intentional with their use of analogies – they plan an analogy before use and explain its limitation, but mostly use analogies in the body of their lessons. There was no significant difference between science teachers' use of analogy based on their teaching experience. The study concluded that analogy use is not considered a science teacher's primary instructional strategy, but rather one that can be used to supplement the conventional methods of teaching. It was recommended that secondary school science teachers consider using more analogies in the introductory and concluding stage of their lessons.

KEY WORDS: Analogy; misconception; Nigerian classrooms; science; secondary school science teachers

INTRODUCTION

Science can be seen as a body of knowledge. It could also mean a way or method of investigation and a way of thinking in an attempt to understand nature (Abimbola, 2013). Science is an activity carried out through thinking and investigation to have an understanding of nature. This scientific knowledge is used for invention in the quest to make life better, conducive, safe, and habitable (Akintola and Ayanlola, 2019). The branches of science, also referred to as sciences, scientific fields, or scientific disciplines, are commonly divided into three major groups: Formal sciences – the study of formal systems, such as those under the branches of logic and mathematics, which use an a priori, as opposed to empirical, methodology; Natural sciences – the study of natural phenomena (including cosmological, geological, physical, chemical, and biological factors of the universe) which can be divided into two main branches – physical science and life science; and social sciences – the study of human behavior in its social and cultural aspects (Wikipedia, 2022a).

Physics and chemistry are two of the main branches of physical science whose application cuts across many professions. They both study matter. However, the major difference between the two lies in their scope and approach (Wikipedia, 2022b). While physics is concerned with the study of the fundamental laws that govern the behavior of matter, energy, and the universe, chemistry focuses on the composition, properties, and reactions of matter. Applications of physics and chemistry span many disciplines, including engineering, medicine, agriculture, and technology. For example, engineers rely on physics to design and develop new technologies such as advanced materials and renewable energy sources. Similarly, chemistry is essential to the development of new drugs, agricultural fertilizers, and food preservatives. Moreover, studying physics and chemistry in fields such as geology, astronomy, and environmental science is essential as it helps us understand the behavior of natural phenomena such as weather patterns, seismic activity, and star and galaxy formation. A deep understanding of these subjects is essential to solving real-world problems and developing innovative solutions to address the challenges facing our world today. According to the Federal Republic of Nigeria (2014), one of the actions taken by the government to fully realize its educational goals in Nigeria is to create special provisions and incentives for the study of science at each level of the country's education system. With this in mind, it is clear that teaching science is synonymous with realizing Nigeria's educational goals and aspirations.

Despite the many benefits that science gives, the process of transferring its body of knowledge is often faced with numerous difficulties which may impede the effectiveness of its teaching-learning process. Science concepts are generally abstract requiring teachers to constantly seek more effective and efficient ways of teaching them. Rahayu and Sutrisno (2019) particularly noted that chemistry concepts are abstract and students need appropriate instructional procedures to

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provide images of the things which cannot be seen. This is also true for students learning physics as Jonane (2015) found that the interest in physics among Latvian school-aged youth is low, mainly due to the difficulty experienced by the teacher in effecting a core feature of learning science, that is, conceptual change in the students' learning. It is not uncommon for science students to hold various beliefs or conceptions that are not consistent with the intended meaning. These beliefs are termed "misconceptions." According to Özmen (2004), misconception means any concept that differs from the commonly accepted scientific understanding of the term. These misconceptions often affect students' learning of new scientific knowledge. Interestingly, misconceptions occur at all levels of learning (Johnstone and Kellett, 1980). The findings of Khalid (2003) revealed that sometimes students have such strong misconceptions that even after learning the correct concepts in the classrooms, they resist modifying their pre-existing ideas. Instead, they try to interpret the newly acquired knowledge using their preconceptions.

For teachers and educators, teaching activities must result in a relatively permanent change in learners' behavior, that is, learning. When students fail to grasp the information holistically, alternative conceptions develop, inhibiting their ability to construct further. Alternative conceptions whether present before or developed during learning make students' learning deficient. Many students may even carry these alternative conceptions beyond school (Ballard, 2011). This implies that for successful learning to take place, secondary school science teachers must take into account the learner's possible preconceptions that may hinder meaningful learning. The use of an analogy is useful for preventing such misconceptions (Nussbaum, 1981).

Analogy is one of the most important instructional tools that can be used to address students' misconceptions. An analogy is a comparison of identity or similarity of elements or relations, that is, on shared properties or identical relations (Johansen, 2002). An analogy could be a diagram, real-life example, cartoon, allegory, parable, pair of words which have similar relationships, metaphor, game, paper craft, mime, an animation clip, or anything else that is created by an imaginative teacher to enable a student to participate actively and to grasp the concept (Ballard, 2011). According to Maharaj-Sharma and Sharma (2015), an analogy consists of two components: The "analog" and the "target." The analog, the familiar situation or object, provides a model through which students can make assumptions and inferences about the unfamiliar or new situation or object, called the target. For example, in one analogy of the structure of an atom – the target, the analog is the arrangement of planets orbiting the sun.

The use of analogies helps to make the unfamiliar familiar and this is particularly important while teaching science. The main purpose of using analogy as a strategy deployed in teaching is that of developing an understanding of abstract phenomena from concrete reference (Genç, 2013). In studies which were carried out relating to many courses (Aykutlu, 2012; Aykutlu and Şen, 2011,), it was concluded that analogies were effective in eliminating conceptual mistakes and in the retention of knowledge. In a research carried out by Dinçer (2011), it was found that analogies had a positive impact on student's academic success, and it raises the level of information retention. Although some analogies are not as effective as others, they generally help students to understand, visualize, and remember what they have learned in class. Some of the studies carried out on the effect of analogies (Çalik and Kaya, 2012; Heywood, 2010; Kılıç and Umdu-Topsakal, 2011; Ören et al., 2011) indicated that the use of the analogy technique had a positive influence on learning.

Literature has shown that there are potential challenges associated with classroom analogy use. Orgill et al. (2015) noted three possible reasons for these challenges. First, because analogies rely on students' understanding of a "familiar" analog domain and students enter a classroom with different prior knowledge, thus the analogies are not equally well understood by all students. Second, students may be unable to distinguish between the analog and target concepts and, thus, perceive the analogy as reality. Finally, and perhaps most importantly, every analogy is inherently limited in scope. Due to these, students may develop misconceptions when they inappropriately apply what they know about the analog domain to a target domain.

Orgill and Bodner (2004) conducted a study to determine which analogies were useful for students and how analogies should be presented to be useful for students. To achieve these purposes, the interview method was considered suitable. Students who were taking or had taken at least one semester of biochemistry class were interviewed during the spring 2002 semester. The sample consisted of 43 students: Nine from the 100-level biochemistry class, 23 from the 300-level biochemistry class, and 11 upperclassmen and graduate students. The findings of the study revealed that students believed that the reasons why analogies were not useful were related to how their instructors presented the analogies in class. The students' responses to the interview questions revealed that instructors should make the purpose for using the analogy clear; explain the relationships between the analog and target concepts; do not overuse analogies; use visuals; use easy-to-understand words and enthusiasm to present analogies; and try them out on other students first. If teachers fail to appropriately use an analogy, it may lead to further misconceptions.

Maharaj-Sharma and Sharma (2015) observed science teachers' use of analogies in secondary school classrooms. The purpose of their study was to examine and interpret how science teachers in Trinidad and Tobago used analogies in their science teaching. An interpretative research methodology was used to investigate the nature and frequency of analogies used by secondary school science teachers. The sample consisted of five teachers from the science department. Data were collected using observation and interview methods. The teachers were observed across 30 lessons. It was observed that overall, only a few analogies were used by the science teachers.

Specifically, studies have been conducted on the use of analogy in teaching Physics and Chemistry. Jonane (2015) conducted a study on teachers' views and experiences in Latvia. The study sought to identify Latvian physics teachers' views on the importance of analogies and the methodology of their usage in physics education, as well as to discover innovative examples of analogies. The study employed a mixed method design where 35 secondary school physics teachers were surveyed using a questionnaire and group interviews with 18 experienced physics teachers. The findings revealed that, in general, now and then Latvian physics teachers use analogies in their pedagogical practice, although they are mostly simplistic and with illustrative character. Some teachers use analogies to help students build new knowledge through activating, transferring, and applying existing knowledge and skills in unfamiliar situations.

Akaygun et al. (2018) conducted a study titled, "teaching chemistry with analogies around the world: Views of Teachers from four countries." The sample of their study consisted of 140 high school chemistry teachers across four different countries (Australia, USA, Thailand, and Turkey). The results of the study indicated that teachers across the four countries had similarities and differences in their use of analogies. It was observed that in all four countries, the majority (76–88%) of the chemistry teachers indicated that they used analogies in a frequency ranging from "sometimes" to "often." In all four countries, none of the teachers said they never use analogies. Very few (3–5) teachers, in all countries, said that they rarely or almost always used analogies. It was also discovered that while the chemistry teachers in Australia evaluated the analogies to check their effectiveness for student understanding, this was rarely the case in other countries.

Maharaj-Sharma and Sharma (2017) conducted a study on the experiences of Trinidadian physics teachers in analogy use. The purpose of the study was to identify Trinidadian teachers' views on the use of analogies in physics teaching and to evaluate teachers' beliefs about the role of analogies in the promotion of higher-order thinking among their students. Both qualitative and quantitative approaches were adopted in the study. The findings of the study revealed that overall; the participants believed that learning by analogies is a skill that students need to develop. The participating teachers likewise indicated that analogies should; be correct and accurately phrased, be used for information transfer, and be mapped onto real-life objects or processes as well as onto prior knowledge or skills.

Literature is awash with numerous studies on the effects of analogy use on students' learning both in chemistry, physics, and other related science subjects such as biochemistry and biology (Çalık and Kaya, 2012; Heywood, 2010; Kılıç and Umdu-Topsakal, 2011; Ören et al., 2011). Several studies have investigated how teachers or students perceived the use of analogies (Orgill and Bodner, 2004; Akaygun et al., 2018; Jonane, 2015). However, none of these studies has accounted for how the analogy is being used by science teachers within the context of Nigerian education. Hence, this study sought to fill this knowledge gap by investigating the practices of secondary school science teachers during classroom analogy use in Ilorin, Kwara state, Nigeria.

Purpose of the Study

The purpose of this study was to assess science teachers' use of analogies in secondary school classrooms in Ilorin. Specifically, this study sought to:

1. Determine the practices of science teachers in using analogies.
2. Identify the topics commonly taught with analogies in senior secondary schools' science classrooms.
3. Determine the difference in practices of analogies among science teachers based on their teaching experience.

Research Questions

The following research questions were derived from the research purposes to guide the study:

1. What are the practices of senior school science teachers toward their use of analogies?
2. What are the science topics commonly taught with analogies in senior secondary school classrooms?
3. What is the difference in the practices of analogies among the less experienced, moderately experienced, and highly experienced science teachers?

METHODS

Research Design

A quantitative, descriptive, and research design was adopted in carrying out the present study due to the necessity of allowing numerical representation and processing of observations to describe and explain the procedures that these observations reflect. An observational design, rather than an experimental one, was used for this research. This design involves the collection of data without manipulating the information from respondents. Researchers that use this approach do not have any control over the independent (predictive) variables that impact the consequences of their findings on the dependent (outcome) variable and the surroundings they investigate (Aggarwal and Ranganathan, 2019). The study aimed to examine how these science teachers use analogies in classroom teaching, thus, there was no need for the researcher to manipulate the natural environment. In addition, to accomplish the aims of the study, the study adopted the survey approach where respondents were allowed to answer the items without any external influence from the researcher (Sanders, 2018).

Research Participants

The population for this study consists of all the senior secondary school science teachers in Ilorin, Kwara State. The study focused on science teachers in the three sub-regions of Ilorin, that is, Ilorin South, Ilorin East, and Ilorin West. The convenience sampling method was used to obtain a sample of

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80 science teachers from 34 senior secondary schools across the three sub-regions in Ilorin. The convenience sampling technique was considered appropriate mainly because it was practically impossible for the researcher to access all the science teachers in Ilorin, and partly due to the limited material resources available at the time this research was being conducted. The participating schools were selected based on their ease of access and the level of cooperation from the staff and management. The science teachers were selected across the three levels of the secondary schools (i.e., SSS 1–3). This diversity in sample selection allowed for a wider range of opinions and perspectives on the concept being studied.

A letter of introduction obtained from the Department of Science Education, University of Ilorin, Ilorin, Nigeria, was presented to the appropriate authority of the sampled schools to seek approval before engaging with any of their teachers. The teachers were provided with a consent form to seek their consent to participate in the study and to ensure that their participation in the study was voluntary. All ethical issues such as non-disclosure of the personality of the respondents, non-exposure of the participants to any form or risks, and not compelling or intimidating the participants in any form were strictly adhered to.

Research Instruments

The instrument used in collecting data for this research was a researcher-designed questionnaire which consisted of three sections: A, B, and C (see Appendix). Section A collected information on the respondents' demographic data. Section B elicited information on the science teachers' practices on analogies, while section C collected information about the science topics commonly taught with analogies. Section B adopted a scale of "Yes," "No" and "Sometimes," as well as multiple choice questions for respondents to select from, while Section C utilized an open-ended question to collect the desired information. The questionnaire was printed out and handed over to each participant to fill out. The researcher personally administered the questionnaire and waited for them to be filled and retrieved before leaving the schools. The data collection exercise lasted for a month during which the researcher visited different schools at least thrice a week. The face and content validity of the instrument was determined by two senior lecturers in the field of science education.

Data Analysis

The data gathered from administering the questionnaires were subjected to descriptive and inferential statistical analyses using the SPSS version 25. The analyses were carried out based on the research questions and hypotheses raised in the study. The reliability coefficient of the final version of the instrument was determined using Cronbach's Alpha method and it was found to be 0.5 which is considered acceptable (Perry et al., 2004) for a scale with <10 items.

RESULTS

The demographic data of the participants are presented in Table 1. On the gender distribution of the respondents, Table 1 shows that 36 (45.0%) of the respondents were male, while 44 (55.0%) were females. On the academic qualification, only 1 (1.30%) of the respondents held a PhD. degree and 24 (30.00%) held an M.Sc./M.Ed./MBA degree, while a larger share of the respondents 55 (68.80%) were B.Sc./B.Ed./HND holders. Furthermore, from the teaching experience, 31.3% of the respondents indicated that they had 0–5 years of experience in teaching science followed by 5–10 years of experience (46.3%), 10–20 years of experience (20.0%), and more than 20 years of experience (20.0%).

Table 1: Demographic characteristics of the participants

Demographic values	Frequency (%)
Gender	
Male	36 (45.0)
Female	44 (55.0)
Total	80 (100.0)
Academic qualification	
PhD	1 (1.3)
M.Sc./M.Ed./MBA	24 (30.0)
B.Sc./B.Ed./HND	55 (68.8)
Total	80 (100.0)
Teaching experience (years)	
0–5	25 (31.3)
5–10	37 (46.3)
10–20	16 (20.0)
20 and above	2 (2.5)
Total	80 (100.0)

Research Question 1: What are the practices of senior school science teachers toward their use of analogies?

Section B of the questionnaire was designed to provide insight into how analogies are used by these science teachers. The results presented in Table 2 reveal the extent of some of the various practices of the science teachers in their use of analogies. As shown in Table 2, about 60.0% of the science teachers explained the limitations of each analogy used in their science lessons; 61.3% of the teachers planned their analogy before its use in the classroom; 82.5% of the teachers used analogies to teach difficult science concepts; 62.5% of the teachers taught with pictorial analogies; and while 65.0% of them stated the purpose of the analogy before its use. It is important to note that 47.5% of science teachers encouraged their students to use analogies, while 30% of the science teachers sometimes did, and 22.5% did not.

The science teachers were asked to select the stages where they mostly use an analogy. The analysis of their responses, as shown in Table 3, showed that most of the science teachers used an analogy in the body of their lesson representing 71.3% of the total positive responses. About 34% of the science teachers used an analogy in the introduction stage, while only 3.8% used an analogy when concluding the lesson.

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Table 2: Science teacher's practices toward the use of analogies

Items	Count (%)		
	Yes	No	Sometimes
I explain the limitations of each analogy used in my science lessons	47 (58.8)	12 (15.0)	21 (26.3)
I plan my analogies before going to teach in the classroom	49 (61.3)	9 (11.3)	22 (27.5)
I use analogies for teaching difficult science concepts	66 (82.5)	1 (1.3)	13 (16.3)
I encourage students to create their analogies when learning	38 (47.5)	18 (22.5)	24 (30.0)
I teach with pictorial analogies in my science lessons	50 (62.5)	10 (12.5)	20 (25.0)
I state the purpose of the analogy before implementing it in science classrooms	52 (65.0)	9 (11.3)	19 (23.8)

Table 3: Stage of use of analogies in the classroom

Stage of lesson	Frequency (%)
Introduction[a]	27 (33.8)
Body[a]	57 (71.3)
Conclusion[a]	3 (3.8)

[a]Reflects the number and percentage of participants answering "yes" to this question

The science teachers were also asked to indicate how often they used analogies and the analysis of their responses is presented in Table 4. The results revealed that approximately 44% of the teachers *sometimes* used analogies, while 35%, 16%, and 5% of the teachers used analogies in a frequency of *often*, *almost always,* and *rarely,* respectively.

Research Question 2: What are the science topics commonly taught with analogies in senior secondary school classrooms?

Based on the coding of the teachers' responses, the science topics/concept commonly taught with analogies are presented in Table 5. Table shows organic chemistry, electrolysis/electrochemistry, separation technique, gas laws, chemical equilibrium and periodic table/periodicity, types and rates of reaction, chemical bonding/combination, qualitative analysis and quantitative analysis, and redox reaction as the most taught having the highest relative percentages of 25%, 23.75%, 17.5%, 12.5%, 11.25%, 10%, 7.50%, 7.50%, 7.50%, and 7.50%, respectively.

Research Question 3: What is the difference in practices of analogies among science teachers based on teaching experience?

Table 6 indicates that the mean practice score of the highly experienced (M = 2.75), moderately experienced (M = 2.36), and low experienced science teachers (M = 2.53) were not similar. This result suggests that there is a difference in science teachers' awareness of analogy.

Table 4: Rate of analogy use in science classrooms

Variable	Frequency (%)
Rarely	4 (5.0)
Sometimes	35 (43.8)
Often	28 (35.0)
Almost always	13 (16.3)
Total	80 (100.0)

Table 5: Science topics/concepts commonly taught by science teachers

Topic concept	Frequency (%)	Total (%)
Organic chemistry	20 (25.00)	80 (100)
Electrolysis/electrochemistry	19 (23.75)	80 (100)
Separation technique	14 (17.50)	80 (100)
Gas laws	10 (12.50)	80 (100)
Chemical equilibrium	9 (11.25)	80 (100)
Periodic table/periodicity	8 (10.00)	80 (100)
Types and rates of reaction	6 (7.50)	80 (100)
Chemical bonding/combination	6 (7.50)	80 (100)
Qualitative analysis and quantitative analysis	6 (7.50)	80 (100)
Redox reaction	6 (7.50)	80 (100)
Stoichiometry of reactions	5 (6.25)	80 (100)
Kinetic theory of matter	5 (6.25)	80 (100)
Balancing chemical equations	5 (6.25)	80 (100)
Kinetic theory of gases	4 (5.00)	80 (100)
Atomic structure/atomic theory	4 (5.00)	80 (100)
Acid-base and salts	3 (3.75)	80 (100)
Properties and state of matter	3 (3.75)	80 (100)
Compounds and mixture	3 (3.75)	80 (100)
Solubility	2 (2.50)	80 (100)
Mole concept	2 (2.50)	80 (100)
Empirical and molecular formula	2 (2.50)	80 (100)
Thermodynamics	2 (2.50)	80 (100)
Metals and their compounds	2 (2.50)	80 (100)
Atoms, molecules, and ions	2 (2.50)	80 (100)
The heat of chemical reaction	1 (1.25)	80 (100)
Introduction to chemistry	1 (1.25)	80 (100)
Relative molecular mass	1 (1.25)	80 (100)
Law of multiple proportions	1 (1.25)	80 (100)
Chemistry and industry	1 (1.25)	80 (100)

H_0: There is no significant difference between the practices of analogy among the less experienced, moderately experienced, and highly experienced science teachers.

To test this null hypothesis, a one-way ANOVA was performed to compare the difference in practices of analogy among science teachers based on their teaching experience. The results of the analysis as shown in Table 7 revealed that there was no significant difference in practices between at least two groups (F (2,77) = 1.89, ρ = 0.16). Since the significant value of 0.16 is greater than 0.05, it implies that there is no significant difference between practices of analogy among less experienced, moderately experienced, and highly experienced

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Table 6: Mean practice scores on the use of analogies based on science teacher's teaching experience

Teaching experience	*n*	Mean	SD
Less experienced	62	2.53	0.33
Moderately experienced	16	2.36	0.47
Highly experienced	2	2.75	0.35

SD: Standard deviation

Table 7: The analysis of variance analysis of the difference in practices of analogies among science teachers based on teaching experience

Category	Sum of squares	df	Mean square	*F*	Significant	Decision
Between groups	0.49	2	0.25	1.89	0.16	Not rejected
Within groups	9.98	77	0.13			
Total	10.47	79				

science teachers. Therefore, the null hypothesis was not rejected.

DISCUSSION

The present study investigated the use of analogies by secondary school science teachers in Ilorin, Nigeria. The findings of the study revealed interesting insights into the practices of science teachers concerning the use of analogies in their classrooms. First, the results showed that a high percentage of science teachers (82.5%) used analogies to teach difficult science concepts, which indicates that analogies are an effective teaching tool in science education. The majority of the science teachers reported that they always explained the limitations of each of the analogies used in their lessons, planned their analogy before its use in the classroom, stated the purpose of the analogy before implementing it in science classrooms, and generally taught with pictorial analogies. These practices are consistent with the recommendations of the literature on effective analogy use (e.g., Glynn, 2007; Harrison and Treagust, 2006). However, a slightly lower percentage of the teachers (47.5%) encouraged their students to use analogies. This could be because teachers may perceive students' ability to use analogies effectively as limited. It also suggests that there is room for improvement in fostering students' generation and evaluation of analogies, which can enhance their conceptual understanding and metacognitive skills (Dagher and Erduran, 2014; Orgill and Bodner, 2004).

Another noteworthy finding of this study is that science teachers mostly used analogies in the "body" of their lessons, with only a third of them who used analogies in the "introduction" stage, while only 3.8% in the conclusion stage. These outcomes are consistent with the findings of Maharaj-Sharma and Sharma (2015), who found that in all six lessons observed in their work, science teachers used analogies in the body of their lessons. This indicates that analogies are mainly used as explanatory tools rather than motivational or evaluative tools. It also implies that science teachers may not be aware of the potential benefits of using analogies at different stages of the lesson to capture students' attention, activate their prior knowledge, reinforce their learning outcomes, or assess their understanding (Aubusson et al., 2009; Treagust et al., 1992). In addition, a considerable number of science teachers were found to use their analogies in the frequency of "sometimes" and "often," respectively. This finding is consistent with the study conducted by Akaygun et al. (2018) who noted that 76–88% of their science teachers used analogies in a frequency ranging from "sometimes" to "often."

Furthermore, this study identified the science topics/concepts most commonly taught with analogies by secondary school science teachers. These include organic chemistry, electrolysis/electrochemistry, separation technique, gas laws, chemical equilibrium, periodic table/periodicity, types and rates of reaction, chemical bonding/combination, qualitative analysis and quantitative analysis, and redox reaction. These topics/concepts are generally considered abstract, complex, or challenging by both teachers and students (Coll and Treagust, 2003; Taber and Tan, 2011). Therefore, it was not surprising that teachers resorted to analogies to make these topics/concepts more concrete, familiar, or comprehensible for their students. However, it is important to note that not all analogies are equally effective or appropriate for different topics/concepts or different levels of students. Teachers need to carefully select and evaluate the analogies they use based on their pedagogical goals, students' characteristics and needs, and the nature and limitations of the analogies themselves (Brown and Salter, 2010).

Finally, this study revealed that there was no significant difference in the practices of analogy among less experienced, moderately experienced, and highly experienced science teachers. This suggests that teachers' use of analogies is not influenced by their years of teaching experience but rather by other factors such as their content knowledge, pedagogical content knowledge, beliefs about teaching and learning chemistry, or availability and accessibility of analogy resources.

CONCLUSION

This research study investigated the common practices of science teachers while using an analogy in the classroom. The findings of this study indicated that science teachers used their analogies more intentionally bearing in mind the limitation of the analogy. They planned for it before it is used in the classroom, and mostly used an analogy to teach science topics that were hard to grasp. In addition, science teachers also adopted the use of pictorial analogies instead of just word-of-mouth. It was, however, seen that fewer science teachers encouraged their students to use analogies which are quite baffling considering the numerous benefits that analogies

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present. A possible explanation for this finding could be that it takes more time to engage in such stimulating exercises whereby students are allowed to express themselves more freely, while displaying their ingenuity.

Furthermore, science teachers mostly use analogies in the body of their lesson while only a tiny percentage of the teachers used them while concluding their science lesson. The lower number of teachers found to use analogies in the introductory and concluding part of the lesson suggests that these science teachers are not aware of the benefits of analogy in these other crucial stages of the lesson. In addition, most of the science teachers "sometimes" use analogies which suggest that science teachers do not consider the use of analogy as their primary instructional strategy, but as one that can be used to supplement the conventional methods of teaching. Due to the abstract nature of the "carbon world," the use of analogy was found most useful to help cultivate the students' imagination. Several science topics were identified as those most commonly taught with analogies. However, organic chemistry was considered to be the concept that requires the most use of analogies. Finally, being less experienced, moderately experienced, or highly experienced did not make a difference in how the science teachers use an analogy in their classroom teaching.

In conclusion, analogies have been proven to be a useful tool for science teachers when delivering their lessons due to their practical effectiveness in clearing students' doubts and ease of use. Further research could be done to investigate how science teachers can promote the use of analogies by their students.

Recommendations

The following recommendations are given based on the findings of this study:

- Science teachers should consider using more analogies in the introductory and concluding stage of their lessons.
- Students should be guided and encouraged to create their own when learning a new science concept.
- Further studies could be extended specifically to other science subjects like biology to understand how the teachers use analogy while teaching in Nigerian classrooms.

Ethical Statement

Before the commencement of data collection for the study, ethical approval for this study was granted by the Department of Science Education in the year 2022.

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APPENDIX

Questionnaire Sample

SECTION B:

S/N	Science Teachers' practices on Analogies	YES	NO	SOMETIMES
1.	I explain the limitations of each analogy used in my science lessons			
2.	I plan my analogies before going to teach in the classroom			
3.	I use analogies for teaching difficult science concepts			
4.	I encourage students to create their analogies when learning			
5.	I teach with pictorial analogies in my science lessons			
6.	I state the purpose of the analogy before implementing it in science classrooms			

Instruction: Kindly select any option that best describes your response

7. In what part of the lesson do you use analogies?

- Introduction
- Body
- Conclusion

8. How often do you use analogies?

- Rarely
- Sometimes
- Often
- Almost Always

SECTION C: Kindly put down your response in the space provided

Which science topics/concepts do you commonly teach with analogies?