Boosting Students' Interest In Solubility Concept Through the Usage Of 8E Learning Cycle Model-Based Strategy

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ABSTRACT

The 8E learning cycle model-based strategy used in this study is an expansion of the 7E model once proposed by Eisenkraft. Although research showed that 7E has a positive effect on a number of students' learning outcomes, we observed that this model lacks a stage where students' alternative conceptions are directly addressed; hence, the rationale behind the proposed 8E, which specified an 'Exhibit' stage. This study determined the efficacy of an 8E model in boosting students' interest in the solubility concept. One hundred and eighty-one senior second-year students sampled from four public secondary schools in Ibadan, Oyo State, Nigeria were used for the study. The pre-test, post-test quasi-experimental design was adopted for this study. Two intact classes from two randomly selected schools were taught solubility and its related topics using lesson plans for an 8E learning cycle model-based strategy (experimental group) while the other two intact classes were taught using lesson plans for traditional teaching method (control group). The Interest in Solubility Questionnaire (ISQ) was administered before and after the intervention. Analyses of pre-test and post-test interest scores of experimental and control groups indicated that while 8E was significantly efficacious in improving students' interest in solubility, the experimental group did better than the control group. We, therefore, concluded that the addition of an 'Exhibit' stage to 7E learning cycle model as a way of directly addressing students' alternative conceptions in solubility, needs to be further looked into as it has been shown to make students' interest in the concept better.

Keywords: inquiry learning, learning cycles, solubility, students' interest, exhibit stage

INTRODUCTION

Chemistry as a branch of science is relevant to science education for teachers, learners and the nation at large. It is a subject that deals with the properties and reactions of substances which may be in any form: solidified, liquefied or gaseous at a particular heat and pressure. This science subject is also concerned with the principles prevailing over the changes that matter undergoes. It is thus, the study of how this matter interacts with other matter and energy in ways that cannot be described in Biology or Physics. Central to all the physical sciences, chemistry as a human academic endeavour relies on basic qualities like creativity, insights, reasoning, and skills. An

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individual's capacity to integrate his or her cognitive, affective and psychomotor skills is required to study chemistry at any level (Woldeamanuel, Atagana and Engida, 2013).

Chemistry students learn to develop and exhibit skills such as inquiry, critical thinking, objectivity, rational reasoning, experimenting, logical deductions, logical reasoning, among others. In Nigeria, chemistry is offered to science students in senior secondary schools. A distinction or credit pass in O' level chemistry is usually a requirement for studying any science (physical) related course such as Medicine, Biochemistry, Engineering and Nursing in any higher institution, especially the University. Some of the objectives of teaching chemistry in senior secondary schools include: to develop basic knowledge and understanding of chemistry concepts at a higher level; to develop inter-relation between chemical substances, their properties and application in life; to show chemistry and its link to industry, everyday life, benefits and hazards; to develop scientific attitude and scientific thinking (Nwoji, 2015).

Solubility is one of the important subject themes in secondary school chemistry curriculum. Learning solubility should deepen a student's conceptualisation of the mole concept and demonstrate the relationship between volume and mass. Solubility, as a concept, comprises water, solutions and solubility and draws its basis from the mole concept and relates directly to volumetric and qualitative analysis. Furthermore, a good understanding of solubility is essential for learning more advanced topics such as organic chemistry, chemical kinetics, chemical equilibrium, thermodynamics, acid-base equilibrium, and electrochemistry, to name a few. Etiubong and Udoh (2017) averred that understanding solubility reinforces science students' knowledge in making career choices. This is because the knowledge of solubility concepts is applied in careers such as pharmacy, pharmacology, chemical research, cosmetology, and food production.

Furthermore, solubility is important in everyday life as solutions can be found almost everywhere on the earth: from the water bodies to the sky to every ocean and every lake on earth. This is because water mixes with dirt, salt, and several substances to become a new substance that renders the water unfit for drinking. Also, smoke can mix with clouds and create a solution of acid rain. Some practical applications of solubility in our lives include water purification, making and carbonating drinks and vitamin storage.

While students generally find some chemistry concepts exciting and easy to learn or relate to, others are perceived as complex. Among the chemistry concepts that pose a problem for many students is solubility (Gongden, Gongden and Lohdip, 2011; Etiubong and Udoh, 2017). Students consider solubility to be an abstract concept, and many find it an elusive theme. They believe the processes and reactions involved are not easy to understand and explain.

A chemistry student is more likely to understand and appreciate global issues such as water and air pollution, production and sale of fake products, poverty, global warming, and ozone layer depletion. He or she is thus, able to utilise the skills acquired while studying chemistry to identify, analyse and proffer innovative solutions to these problems. However, there is clear evidence of poor achievement in chemistry generally. This has been linked to many factors, including a lack of interest. Edeh and Vikoo (2013) indicated that students' performance in Chemistry might never improve if factors such as interest, previous preparation, study style, parental and teacher influence are flawed.

The Nigerian senior secondary school curriculum for chemistry clearly states that the foremost objective of teaching and learning chemistry should be to develop the interest of students in chemistry as a subject (FME, 2009). Interest is an emotion that causes an individual to pay attention to or focus on an object, event, or process. The concept of interest has also been linked to other concepts such as curiosity, attraction, and surprise. Some psychologists describe interest as an attitude or a certain disposition to give selective or special attention to something. With respect to learning, interest promotes understanding and retention since it makes people process any given texts more deeply. Interest also encourages good meta-cognitive strategies (Silvia, 2007). In science education, one critical goal is to promote students' continued interest and engagement in science (Richards, Colin, Gupta, and Elby, 2013). Students need to remain interested in whatever they are learning in order to develop into active and efficient learners. When learners perceive an event, activity, or a subject as interesting, they would be willing to engage, especially cognitively, in learning the subject. Looking critically, it appears that students' interest in chemistry is minimal.

Based on the author's interactions with a good number of teachers and students, it appears that students' enrolment in chemistry is declining. Chemistry seems to have lost its appeal to many students in Nigeria, and many have low interest in the subject. (Delmang and Gongden, 2016; Otor and Achor, 2013). In a recent study, Nbina (2012) identified students' lack of interest in chemistry as one of the prominent factors responsible for poor academic performance in the subject. This was buttressed by Nnoli (2015) and Delmang and Gongden (2016) saying that students' dwindling interest in chemistry can be traced to the use of obsolete and unexciting teaching strategies by teachers in many schools in Nigeria. Though inconclusive, the findings of the study by Edeh and Vikoo (2013) indicated that students might not do well in chemistry if factors such as interest are defective. Nbina (2012) in addressing this, recommended that chemistry teachers should use active learner-centred teaching strategies.

Singh, Granville and Dika (2010) examined the effects of three school-related constructs (including interest) on 8th grade students' achievement in mathematics and science and found that they were positive. Although Gongden, Gongden and Lohdip (2011) found from their assessment that students' perceived difficulty and their achievement did not correlate significantly, one of the factors responsible for the perceived difficulty, as identified, was lack of interest. Okoye, Okongwu and Nweke (2015) investigated the relationship between students' interest and achievement among 200 SSIII students in Anambra State. Results indicated that higher interest led to better performance among students.

Rotgans and Schmidt (2011) found that teacher factor could influence learners' situational interest in the classroom. Therefore, it is suggested that teachers ought to adopt better teaching strategies that could enhance students' interest. According to Nwoji (2015), the process of teaching and learning can only be meaningful and efficient if accompanied by enriching instructional resources. He added that effective tools could be used in the classroom to improve the learning experience for students. The issue of students' interest in chemistry appears to be one that should not be overlooked and therefore requires further and more extensive research.

Woldeamanuel, Atagana, and Engida (2013) stressed that inadequate methods of teaching will invariably lead to poor performance and would most likely destroy students' interest, especially in chemistry. Some studies point at declining and dwindling interest in chemistry as a consequence of continued use of inadequate, obsolete, and teacher-centred strategies.

Many Nigerians teachers currently use old and uninteresting methods of teaching. Conclusions from classroom observations confirmed that, in practice, most chemistry teachers come to class with obsolete lesson notes and 'dish out' some ambiguous information to passive learners. The lesson plans are hardly glazed with any creativity. Within a conventional chemistry class, the teacher focuses mainly on exhausting the syllabus as quickly as possible. Except for a few sessions of questions and answers, there is little or no participation on the part of the learners. In most cases, the process of learning is too rigid and unappealing to the students. Concepts are taught without creating opportunities for students to make connections between what is taught in class and everyday life. Furthermore, instead of advancing students' reasoning and critical thinking capacity, the students spend more time on taking down notes, staring at the board or listening to the teacher.

For improvement in students' learning outcomes, there is a need for teachers to shift to a more productive, activity-based, and appropriate teaching method (Jack, 2013). Therefore, chemistry teachers need to adopt instructional strategies that are not mainly teacher-directed but would encourage more student involvement (Ogembo, 2012).

Prince and Felder (2006) found that inquiry-based strategies were more effective than conventional deductive methods for achieving a broad range of learning outcomes. Inquiry-based teaching is sometimes referred to as active learning (Savery, 2006). It is a term broadly used to represent a wide range of instructions and teaching interventions that are learner-dependent and provide the learners with an opportunity to undertake investigations by asking questions to solve problems. Learning by inquiry method is a cumulative process. Students are encouraged to think in order to find the knowledge by themselves (Rehorek, 2004, Siribunnam and Tayraukham, 2009) such as in the use of learning cycle model-based strategies.

The 7E Learning Cycle was created by Eisenkraft (2003) when he added the steps of examining prior knowledge and applying knowledge. This model is advantageous because it contains phases where students can check their own knowledge so that they can apply it for further study; this process allows meaningful learning to take place.

However, the author's study investigated the use of an 8E learning cycle model. It describes a constructivist eight-step inquiry-based learning process planned with embedded Conceptual Change Texts for learners to investigate scientific knowledge.

Even though the successful implementation of a 7E-based strategy may reduce many students' misconceptions, the researcher suggests that an additional stage be added in order to avoid unnecessary assumptions by the teacher. This stage is called the 'EXHIBIT' stage. It involves the Presentation of Conceptual Change Texts (CCT). At this stage, the teacher provides statements of typical misconceptions students have about the concept. In these texts, the identified misconceptions are given first and then activated by providing situations developed to elicit a prediction based on them. In this way, misconceptions are confronted with proofs that they are wrong. In other words, students are given the correct explanations supported by examples (Ozmen, 2007). Hence, the name 8E.

Research shows that Conceptual Change Texts (CCT) are effective in aiding students' conceptual understanding of alkenes (Sendur and Toprak, 2013) and their understanding of ecological concepts (Cetin, Ertepinar and Geban, 2015). It is also an easy, economical, and resource-effective way to aid the understanding of the processes of how ions in a solidified state dissolve in water and the effect of solute surface on the disbanding (Calik, Ayas and Coll, 2007). In another study, Turk and Calik (2008) used a combination of conceptual change methods including Analogy, Conceptual Change Text (CCT) and worksheet, within a 5E lesson plan in an attempt to eliminate students' misconceptions in Endothermic-Exothermic reactions. The purpose of this study was to determine if the usage of an 8E Learning cycle model had the capacity to boost students' interest in learning the solubility concept.

LITERATURE REVIEW

The 7E Learning Cycle model

The 7E learning cycle model is an adapted instructional strategy propounded by Eisenkraft (2003). Learning cycles have been in existence within the circle of science education, and was first conceived by Karplus (late 50s-early 60s) and later fully conceptualised by Atkin and Karplus (1962) as guided discovery. A Learning cycle is an inquiry-based learning process for learners to explore scientific knowledge through science process skill and to search for knowledge or significant self-learning experience based on constructivist theory (Polyiem, Nuangchalerm, and Wongchantra, 2011). Initially, the learning cycle was a three-step model comprising surveying, introducing keyword and applying concept. Later, it was expanded into four steps called the 4E learning cycle approach by adding the step of learning presentation. Then, the 4E learning cycle approach has been adapted into the 5E by adding the step of prior knowledge check. Finally, it was extended from the 5E to the 7E learning cycle by including the steps of examining prior knowledge and applying knowledge (Eisenkraft, 2003).

Table 1 Modifications made on Learning Cycles

3-Step Learning Cycle	4E Learning Cycle	5E Learning Cycle	7E Learning Cycle
Exploration			Elicit
Invention/Term Introduction	Engage	Engage	Engage
Content application/Expansion	Explore	Explore	Explore
	Explain	Explain	Explain
	Evaluate	Elaborate	Elaborate
		Evaluate	Evaluate
			Extend

While proposing the expansion of the 5E learning cycle model, Eisenkraft (2003) put into consideration that eliciting prior knowledge was a crucial part of learning, hence, the split of the engage phase into Elicit and Engage. Within the 7E learning cycle, the emphasis is laid on assessing the learner's prior knowledge and determining their readiness before learning the new content. He further took into consideration that research indicates that transfer of learning is a prerequisite for effectiveness in teaching and learning. This led to the expansion of the two stages, Elaborate and Evaluate into three stages; Elaborate, Evaluate and Extend. The 7E model at every stage engages the learners actively in construction of learning while it also supports the use of prior knowledge. In an attempt to make a case for the 7E learning cycle model, Siribunnam and Tayraukham (2009) stressed the importance of memory which fostered recall and retention of information when dealing with new information and submitted that any instructional strategy that does consider the memory could not be effectual. According to these researchers, the inquiry-based instruction, especially the 7E learning cycle model can explain how such a procedure of science learning can deal with novel information. In addition, they stressed that the 7-E learning cycle model was a laudable strategy in that it allowed a student to learn and practice by themselves.

Students also had the opportunity to evaluate themselves positively, not only in a negative way. They were furthermore, well engaged and expressed their feelings freely. During the process of learning, they reported that students experienced continuous structuring and re-structuring of their understanding and had ample opportunity to reflect on their knowledge and experiences. In their experiment, Siribunnam and Tayraukham used a slightly different nomenclature for the 7E. For instance, the first ‘E’ was the Elicitation phase, where the teacher motivates the students to learn by asking questions directed at obtaining students’ prior knowledge and assessing readiness for learning.

This is followed by the Engagement phase, where teachers help students to develop some level of curiosity. Then, comes the Exploration phase where the learners are engaged in practical work, exploring ways of observing, creating a hypothesis, and collecting data. Explanation phase is the fourth ‘E’. Here, the data collected is analysed, summarised, and presented in various formats. The fifth step is called the Expansion or Elaboration phase. At this stage, the students combine the information they have with what they knew previously. The Evaluation phase helps the teacher to ascertain that learning has taken place. This could be done by various means. The seventh ‘E’ represents the Extension phase which centres on the application of newly acquired knowledge.

In a related study, Kanli and Yagbasan (2007) compared the effects of a laboratory-based and 7E Learning Cycle Model with a verification laboratory approach on university students' development of science process skills and conceptual achievement. The study which was conducted on 81 freshman university students who were taking the General Physics Laboratory 1 course at a Turkish University, yielded positive results in favour of the 7E-based laboratory group. The researchers concluded from their findings that the laboratory approach based on 7E learning cycle model (Excite, Explore, Explain, Elaborate, Extend, Exchange and Evaluate) was more effective than the conventional laboratory approach in science instruction in improving learners' science process skills and correcting common misconceptions about force and motion.

In another study, Sevda (2013) investigated the impact of epistemologically and metacognitively stimulated 7E learning cycle (EM-7ELC) on tenth-grade students' learning outcomes in physics. Data collected from 107 participants in a school in Ankara, Turkey, showed that the experimental group performed better.

In contrast to these, Gonen, Kocakaya and Inan (2006) conducted a comparative study on the effects of a computer-assisted programme and 7E model-based lessons on students' achievement in electrostatics and attitudes to Physics. The results obtained showed that while there was a significant difference in the knowledge and comprehension levels, no significant difference existed at the level of application. Students that belonged to computer-assisted instruction group performed better than the 7E constructive learning instruction group. Also, the difference between the attitudes of students in the experimental and control groups was not significant. Therefore, it was concluded that the computer-assisted teaching knowledge and cognition levels are more effective that the 7E model.

Use of Conceptual Change Texts (CCT) in Instructional Strategies

Conceptual Change Text (CCT) is a text which asks students to envisage the result of certain circumstances before they have access to the statements that accompanied the cases which reveal the irregularity between students' misconceptions and its corresponding scientific facts (Çakır, Geban and Yürük, 2002). The use of Conceptual Change Text (CCT) is an efficient technique to correct students' misconceptions (Tekin, Kolomuç and Ayas, 2004). Conventional teaching techniques cannot adequately bring about a modification of learners' behaviour. According to Tekin, Kolomuç and Ayas (2004), in the CCT model, the teacher first identifies common misconceptions. Then, students' misconceptions are stimulated when they are presented with a situation that is intended to obtain a prediction based on the opinion or knowledge that they hold. After this, students' misconceptions are challenged by introducing ample evidence showing that they are wrong. Then the teacher presents the correct scientific explanation.

In a related study, Tekkaya (2003) investigated the effects of Conceptual Change Text and Concept Mapping strategies on students' achievement in diffusion and osmosis. The finding of the study revealed a significant difference between the experimental and control groups. The mean percentage of students in the experimental group having a scientifically correct view appreciated from 22.5% to 54.1% (31.6% increase) while the control group improved from 19.1% to 38.7 %(19.6% increase) after treatment.

Gunay (2005) investigated the effectiveness of CCT-based instruction with analogies over conventional instruction in correcting the misconceptions of chemistry learners in the 10th grade, their knowledge of subject themes such as atoms and molecules and attitude to the teaching and learning of chemistry. The researcher found that students in the experimental group had significant achievement gains in atoms and molecules over their counterparts in the control group. Further still, students exposed to the CCT-based instruction had significant improvement in their attitude to chemistry. In agreement with this, the findings of Sendur and Toprak (2013) clearly indicated that students in the experimental group (CCT-based instruction) were better in remediating their misconceptions about alkenes and that CCT is effective in enhancing students' conceptual understanding of alkenes.

Learning Cycle Model and Students' Interest in Solubility Concept

In a bid to transfer knowledge to learners, teachers adopt one teaching method or the other based on their understanding and experience in pedagogy. Therefore, it is not new to say that a teacher's choice of teaching method affects learning outcomes. In agreement with this, Woldeamanuel, Atagana, and Engida (2013) remarked that a bad method of teaching would predetermine poor performance and kill students' interest. Nnoli (2015) blamed students' poor interest in chemistry on poor and ineffective teaching strategies used in most Nigerian schools. If a teaching method is not engaging and does not allow a learner to make connections between the concept learnt and the life outside of the classroom, learners are bound to lose interest in the subject and in some cases, form a relatively permanent negative disposition towards it.

Osborne and Collins (2001) averred that the science-related concepts which involve tangible, visible and units that can be directly manipulated through learner-centred activities such as experimentation and investigation often interest science-biased students. The use of the strategy allowed students' active participation in the process of learning. In addition, two of the four recommendations aimed at improving students' interest in chemistry include connecting chemistry to daily life and employing inquiry-based teaching strategies (Haswell, 2015). Some researchers have reported the importance of acknowledging that students' interactions aid and sustain their situational interest.

Hokkanen (2011) investigated the use of 5E Learning Cycle lesson plans on seventh-grade science students and found that it improved students' interest and motivation in science. The study also reported that the intervention aided content information retention. In another study, Areelu (2014) examined the effects of Tiered Lesson Instructional Strategy and Group Personalisation Instructional Strategy on senior secondary school students' interest in Mathematics in Lagos State. In the study, a modified lecture method was used as a control. Results showed that treatment had a significant main effect on the students' interest in Mathematics and that students classified as having medium mathematical anxiety had improved interests in Mathematics.

NULL HYPOTHESIS

$H_0$1: There is no significant main effect of treatment on students' interest in solubility concept.

METHODOLOGY

Research Design

The study adopted a pretest-posttest control group quasi-experimental design. The experimental design is schematically represented as follows:

Experimental group 1	O_1	X_1	O_3
Control group	O_2	X_2	O_4

O_1 and O_2 represent pre-test observations of experimental groups and control group, respectively.
O_3 and O_4 represent post-test observations of experimental group and control group, respectively.
X_1 represents 8E Learning Cycle Model-Based Strategy
X_2 represents Conventional Teaching Strategy

Selection of Participants

The participants in this study were drawn from Senior School II Chemistry students from four co-educational public secondary schools in Ibadan Metropolis. The schools were purposively selected based on the following criteria:

1. The school must be a Government-owned post-primary institution.
2. The school must have at least 20 students offering chemistry
3. The school must have at least a graduate chemistry teacher with a minimum of five years of teaching experience.
4. The school must have a chemistry laboratory equipped with good practical materials or improvised equipment.

Two intact classes were selected randomly assigned to 8E learning cycle model-based (experimental), and two were assigned conventional teaching group as the control.

Research Instruments

Three properly validated instruments were used in this study. They are:

1. Teacher Instructional Guide for 8E Learning Cycle Model-Based Strategy (Lesson plan)
2. Teacher Instructional Guide for Conventional Teaching Strategy
3. Interest in Solubility Questionnaire (ISQ) (α=0.70)

After obtaining all necessary authorisations, the participating chemistry teachers were duly sensitised and trained in the knowledge, principles, and procedures of the treatment to be used in the study. However, there was no training for the teachers in the control group.

Pre-test

Before the pre-test, the chemistry teachers enlightened the students on the purpose of the tests and advised them to answer them as truthfully and correctly as possible. Interest in Solubility Questionnaire was administered to all the participants (both experimental and control groups).

Treatment

After the pre-test, the teachers in the experimental group taught the chemistry concept using the Teacher Instructional guide for 8E learning cycle model-based strategy while the control group was taught using Teacher Instructional Guide for conventional teaching strategy. The researcher, however, went around to ensure the proper implementation and adherence to the guidelines set for the teachers to follow. An average of three (3) hours per week was utilised to teach the concept. This included time for copying of notes.

Experimental Group (8E Learning Cycle Model-Based Group)

The steps to be taken include:

ELICIT: The students are asked some questions relating to previous topics or concept taught.

- The students respond by providing answers.
- The teacher makes a quick judgment of students' understanding of the previous concept taught, and the teacher provides further explanations or corrections if needed.

ENGAGE:

- The teacher creates an environment for inquiry.
- The students are allowed to make observations and discuss.
- The students write down what their ideas are.

EXPLORE:

- The students are placed in groups of five or six.
- The students are provided a platform to participate in the experiment.
- The students are provided with a set of guidelines for the experiment.
- The students make their deductions and record their findings.

EXPLAIN:

- The teacher provides some examples where necessary.
- The teacher assumes the primary role.
- The teacher explains the concept relating it to the processes experienced in *engage* and *explore*.
- The teacher provides notes.

The EXHIBIT:

- The students are presented with a statement(s) of misconception about the concept.
- The teacher obtains feedback by listening to responses from students.
- Where the misconception exists, the teacher makes appropriate clarification, possibly by showing justification for the right answer.

ELABORATE

- The teacher shows some applications of the concept being taught.

EVALUATE:

- The teacher examines the students for understanding of the concept.
- The teacher gets feedback from learners.

EXTEND:

- The students are given a task that takes further their understanding of the concept.
- The students may take the task (assignment, project, research) home and return it to the teacher for marking.

The Control Group (Conventional Teaching Strategy)

STEP 1:

- The teacher begins the lesson by asking students some questions to ascertain that the students have understood the last class.
- The teacher introduces the topic to be taught

STEP 2:

- The teacher starts to teach the lesson.
- The students pay attention and take down notes.
- The teacher explains the concept.
- The teacher provides examples where needed.
- The teacher may demonstrate one or two processes in front of the students.

STEP 3:

- The teacher asks students if they have questions.
- The teacher provides answers and makes clarifications where necessary.

STEP 4:

- The teacher asks students some questions in order to ascertain if the set objectives have been achieved.
- The teacher may give homework or assignment.

Post-test

The same Interest in Solubility Questionnaire (ISQ) after the topic had been completely taught. The results were collected and analysed using ANCOVA. This was done in order to identify any significant differences in the learning outcomes of the students after exposure to treatment. Data from the experimental group were compared to those of the control group. The entire fieldwork lasted ten weeks

Results

Table 2.1 Analysis of Covariance (ANCOVA) of post-test scores of students' interest in Solubility concept with treatment using pre-test scores as covariates.

Dependent Variable: PoISQ- Post-test scores of Interest in Solubility Questionnaire

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4179.13[a]	18	232.17	3.822	.000*	.248
Intercept	7330.55	1	7330.55	120.664	.000*	.366
PrISQ	707.94	1	707.94	11.653	.001	.053
Treatment	1099.22	2	549.61	9.047	.000*	.080

Table 2.1 shows that there is a significant main effect of treatment on students' interest in solubility concept ($F_{(2, 209)} = 9.047$; $p<0.05$; $\eta^2=0.080$). This implies that the post-test scores of students' interest in solubility differ significantly across the treatment groups and control group with the effect size of 8%. However, the percentage contribution of all the endogenous variables to the variance of the exogenous (dependent) measure is given as 18.3%.Therefore, the null hypothesis H_01 (b) was rejected. The magnitude of the mean scores of interest of each group was determined and is presented in Table 2.2.

Table 2.2 Estimated Marginal Means analysis of the post-test scores of Students' Interest in Solubility Concept by Treatment

Dependent Variable: PoISQ- Post-test scores of Interest in Solubility Questionnaire

			95 % Confidence Interval	
Treatment	**Mean**	**Std Error**	**Lower Bound**	**Upper Bound**
8E	61.15	.84	59.50	62.80
Conventional	54.61	1.52	51.61	57.62

Covariates appearing in the model are evaluated at the following values: PrISQ = 56.27.

PrISQ- Pre-test scores of Interest on Solubility Questionnaire

Table 2.2 indicates that the students in the 8E learning cycle model-based group obtained a higher post-test mean score ($\bar{x}$ = 61.15) while those in the conventional teaching (Control) group obtained the lower score ($\bar{x}$ =54.61).

To further determine the source of the significant difference, a Tukey post hoc test was used, and the result is presented in Table 2.3

Table 2.3 Tukey's post hoc pair wise comparison test of Treatment and Students' Interest in Solubility Concept.

Dependent Variable: PoISQ- Post-test scores of Interest in Solubility Questionnaire

	N	**Mean**	**8E**	**Conventional**
8E	122	61.15		*
	59	51.61	*	

DISCUSSIONS

The findings of this study showed a significant main effect of treatment on students' interest in solubility concepts. Results obtained showed that the post-test scores of students' interest in solubility differ significantly between the treatment group and conventional group. This is in line with the proposition of Lamb, Annetta, Meldrum and Vallett (2012) and Haswell (2015) that students' interest can be improved upon when students learn science in a more exciting environment, and they are able to relate the information obtained in the classroom to everyday life. This was exactly the case when 8E cycle model was employed to teach solubility concept and we expect the same thing to happen even when other difficult concepts in chemistry are the focus of the study.

Interest is a feeling that reflects how much attention one is willing to give to a particular object, event, or activity. It is evident that if students must perform better in a particular academic subject, it is expedient that their interest is captured and sustained. Works that support this include those of Hokkanen (2011) who employed a 5E based lesson plan for improving students' interest in science and also Areelu (2014) agreed that treatment could enhance students' interest in Mathematics.

In the course of this study, it was observed that students had never been exposed to any 'special' teaching method other than the usual teacher-centred methods, which are characterised mainly by rote-learning. Perhaps, the students and teachers found the use of 8E fascinating, thereby stimulating interest in the topic. Inarguably, conventional teaching strategy could sometimes be perceived as dull and uninteresting. In the treatment classes, the teacher was not the sole custodian of knowledge. 8E Learning Cycle Model-based strategy is participatory, and one could conclude that transfer of learning encouraged students' interests in solubility. The results clearly indicated that, with respect to interest, the 8E group improved more than the control group.

It has been observed that in many public schools in Nigeria, students do not normally carry out experiments to time. Due to inadequacy of laboratory materials (chemical and equipment), practicals/experiments are usually done lately. In all the lessons taught in the 8E classes, students were exposed to one form of experiment or the other. In fact, in some cases, students were asked to source for the materials needed within their localities. Students like to do things with their hands, and many students would embrace any opportunity for them to explore, and this prompted their interest more than those in the conventional group.

Besides, it appears that the introduction of CCT further aroused the students' interests and motivated them to want to know more. Perhaps, during the Exhibit stage, the accuracy or rather authenticity of the learners' knowledge was questioned and challenged. Unlike in the regular class, many of the students had the opportunity to share their own thoughts and ideas. They were free to reason and analyse. They also engaged in more practice than theory and rhetoric. Often, when learners are passive in a classroom, the sense of 'enjoyment' is absent. Students' interests, especially in a science subject such as chemistry, must of the essence, be elicited, improved, and sustained.

RECOMMENDATIONS

1. Chemistry teachers should adopt the use of constructivist inquiry-based strategies such as 8E learning cycle model-based strategy for facilitating interest in solubility concept.
2. Teacher training schools should be updated with current and contemporary approaches in the teaching and learning of chemistry. The best way to do this is to incorporate this strategy in the methodology course content. This would enable the teacher trainers to emphasise it whenever they are teaching.

CONCLUSION

When 8E learning cycle model is employed, students' interest in solubility concepts improved. Students can benefit more if they are actively involved in the process of teaching and learning, as this has been shown to boost students' interests. We have endeavoured to showcase the efficacy of 8E model, particularly in boosting the interest of secondary school students towards chemistry. Despite the popularity of 7E model, we also see the 8E model as an innovation in academic teaching circle. Enhancement of interest of students in the subject will, of course, go a long way in making students go for chemistry-related courses in higher institutions of learning. More importantly, in areas such as medicine, its allied courses and engineering. This, no doubt would enhance the socio-economic status of countries such as Nigeria.

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