

**UNIVERSITY FIRST YEAR CHEMISTRY STUDENTS' AND TEACHERS'  
PERCEPTION OF DIFFICULTY OF SELECT TOPICS IN ORGANIC  
CHEMISTRY IN RIVERS STATE OF NIGERIA**

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**ABSTRACT**

This paper provides insight into the perception of those teaching and learning organic chemistry topics; it compares the learners' own perception of organic chemistry topics with teachers' perception of the same organic chemistry topics. *[African Journal of Chemical Education—AJCE 12(1), January 2022]*

## INTRODUCTION

At the beginning of any course, students start their study with a set of beliefs about the nature of learning and what they intend to achieve [1]. These beliefs are derived from earlier school and learning experiences as well as their current goals and motives [2].

Organic chemistry is perceived by students as a difficult subject [3,4,5,6,7,8]. In his early study, Johnstone [9] reported that the problem areas in the chemistry from the pupils' point of view persisted well into university education, one of the most difficult being organic chemistry. Fenham & George [10] investigated problems arising from the learning of organic chemistry. As a follow up while [11] indicated that students had little conceptual understanding of functional groups and their role.

Part of the chemistry course that pre-degree and first year students take is organic chemistry. This is the chemistry of hydrocarbons. This aspect of chemistry is relevant in the understanding of what biochemistry, pharmacy, medical students, engineering and technology students study [12]. This is because of the nature of organic reactions centred around functional groups. So much emphases have been placed on how students learn physical and inorganic chemistry without equivalent consideration for organic chemistry.

Organic chemistry is full of reactions which the students must learn and understand in order to understand some aspects of nature. Yet students are so scared to learn organic chemistry. Just like the previous studies examined students' perception about topics in physical and inorganic chemistry,

there is also the need to study how students perceive topics in organic chemistry. This is necessary because through the findings of this study, we may have started gaining insight into some of the reasons why students have this phobia for organic chemistry.

In trying to examine the perception of students in any discipline, their teachers are considered alongside. This is so because researchers have pointed to the teachers as being part of the problem of the students [13] [14] [15].

Treagust, Duit & Nieswandt [16] stated that more research is necessary to better understand the learning difficulties in the major chemistry topics with a more diverse range of setting as well as in additional topics such as organic chemistry.

According to [3] chemistry lecturers, have given the following reasons for students' underperformance in organic chemistry at the undergraduate level, namely;

- poor background of organic chemistry from the pre-university level;
- students find organic chemistry concepts very complicated;
- students do not want to put effort themselves rather believe in spoon feeding by their lecturers;
- time constraint as the student have a heavy load of work;
- lack of active study, students do not practice by writing to learn and understand
- large intake of students that results in crowded lecturer halls;

- the students tend to memorize rather than understand the concept and therefore fail to apply it in new situations.

Many educational theorists [17, 18, 19] have emphasised the importance of the affective domain in underpinning meaningful learning. The affective domain includes the learners' feelings, motivation and attitudes [20] Novak's theory of education defines meaningful learning as the constructive integration of thinking, feeling, and acting [19] In this way, meaningful learning requires the integration of cognitive, affective and psychomotor learning [21].

O'Dwyer and Childs [5] have pointed out that research in chemical education has focussed on identifying learners' conceptions and experiences of learning. While less research as focussed on the teachers' perceptions of their learners' experiences [22], there is limited specific Chemistry Educational Research (CER) investigating the intricate connexion between teachers' and learners' perspectives of organic chemistry (OC).

This paper therefore provides insight into the perception of those teaching and learning organic chemistry topics it compares the learners' own perception of organic chemistry topics with teachers' perception of the same organic chemistry topics. The following questions are addressed from the perception of both those teaching and those learning select organic chemistry topics.

1. What is the perception of the students about the difficulty of learning organic chemistry topics?

2. What is the teachers' perception about the difficulty their students have with learning organic chemistry?

## **METHODOLOGY**

The study targeted first year students in the university who are studying chemistry as a major course. The students numbered 105 and their teachers 8 from an urban university located in Rivers State of Nigeria. The students involved in this study passed from Senior Secondary Year 3 (SS3) to first year in the university and clearly indicated in their Joint Admission & Matriculation Board (JAMB) forms that they were interested in studying chemistry as a course. The age range of the students was 16 to 18 years. The mean age was 16.2 years with standard deviation (SD) of 1.43 years. Eight teachers (lecturers) of the students took this basic course in the Department of Chemistry of the university.

### **Instrument**

The instrument used in the study is a Perception Rating Questionnaire (PRQ) made up of twenty-two (22) topics in organic chemistry. The students and their teachers were required to indicate against each topic how they perceived the topic. For the students;

- (i) Is the topic very difficult to learn? (VDL)
- (ii) Is the topic difficult to learn? (DL)
- (iii) I am not sure I can learn this topic (I cannot say), so I am undecided (U)

- (iv) Is the topic easy to learn? (EL)
- (v) Is the topic very easy to learn? (VEL)

This rating scale was adopted from previous studies investigating learners' difficulty in Chemistry in UK [23] [24] and in Ireland [25].

The teachers (lecturers) were to indicate against each topic how their students learnt the topics according to the rating scale for the students. The topics were from the scheme of work of the students for a course in chemistry, specifically, dealing with organic chemistry. As at the time of carrying out this study the students had just concluded studying the course and had not been examined. This is the reason why the achievement or performance of the students was not the central issue of the study. What the issue was how the students were studying the various aspects of the course and the process of lesson delivery (as carried out by the lecturers of the students).

## **ANALYSES OF DATA AND FINDINGS**

The rating scale of the questionnaire was trichotomised by merging very difficult to learn (VDL) with difficult to learn (DL). Easy to learn (EL) was merged with very easy to learn (VEL). Undecided (U) was left alone. Frequency distribution of the students' and teachers' responses was centered on VDL, U, and VEL. Difficulty

index in the form of facility index (FI) was calculated for each topic for the learners and teachers by applying the formula

$$FI = \frac{VDL+DL}{VDL+DL+U+EL+VEL} \times \frac{100}{1} \%$$

The result of the calculation for each topic is shown on table 1. Graphs of facility indices with the topics for the learners and the teachers were plotted. This is shown on Fig. 1.

Table 1: Facility Indices of Teachers' and Students' responses to difficulty of topics in organic chemistry (students, N = 105, Teachers, N = 8)

S/No	Topics	Students	Teachers
1.	Classification and nomenclature of organic compounds	6.67%	0.95%
2.	Separation and purification	13.33	25.00
3.	Homologous series	7.62	0.00
4.	Isomerism	9.52	0.95
5.	Sources and properties of alkanes	8.57	0.95
6.	Uses of alkanes	4.76	0.00
7.	Petroleum	10.47	0.95
8.	Sources and properties of Alkenes	9.52	0.93
9.	Laboratory Detection of Alkynes	20.00	1.90
10.	Structure and properties of benzene	21.90	1.90
11.	Chemical properties of benzene	14.28	0.00
12.	Sources, nomenclature and structure of alkanols	11.42	1.90
13.	Classification of alkanols	11.42	1.90
14.	Physical properties of alkanols	17.14	1.90
15.	Laboratory test for alkanols	13.33	1.90
16.	Uses and properties of alkanolic acid	15.23	2.85
17.	Physical properties of esters	16.19	2.85
18.	Chemical properties of esters	13.33	1.90
19.	Fats and oils as esters	17.14	1.90
20.	Sources, nomenclature and structure of esters	13.33	1.90
21.	Sources, physical and chemical properties of fats and oil	13.33	1.90
22.	Soapy and soapless detergents	18.57	1.90
	Mean $\bar{x}$	13.63	2.60

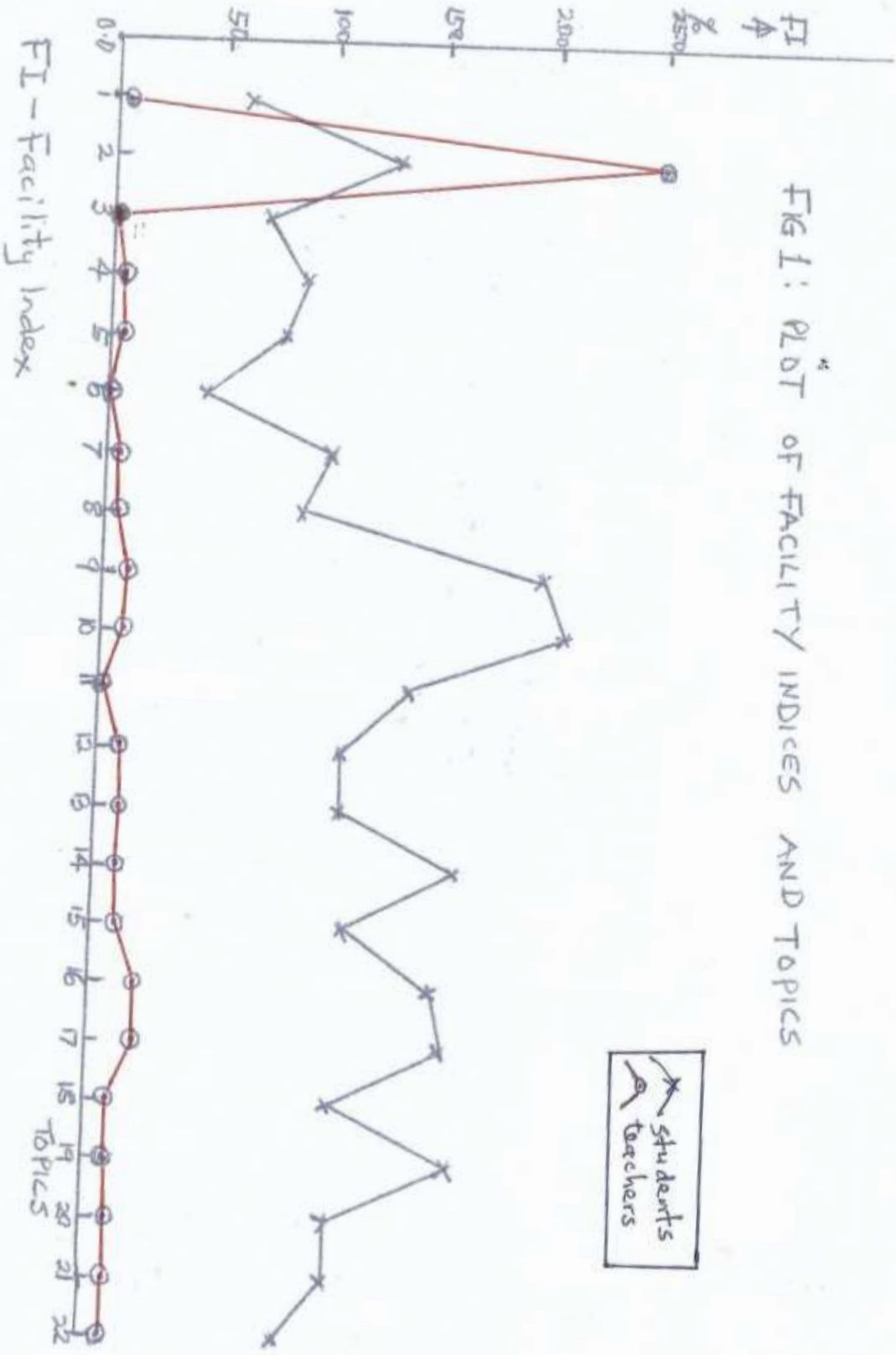


FIG 1: PLOT OF FACILITY INDICES AND TOPICS

students  
teachers



Overall findings of the study revealed that more than 20% of the students indicated that topic numbers 9 & 10 were difficult to understand. These are the topics dealing with laboratory detection of alkynes and structure and properties of benzene Remarkably 25% of the teachers noted that topic 2 (separation and purification of organic compounds) was difficult to understand for the students. In topics 3, 6, 11, teachers indicated no difficulty to the students to learn. These topics are related to homologous series, uses of alkanes and chemical properties of benzene.

Fig. 1 (plot of facility indices and topics) showed a total disagreement between the students and their chemistry teachers. While the students expressed difficulty in learning organic chemistry concepts and principles teachers perceived the topics not too difficult for the students. Remarkably 25% of the chemistry teachers perceived separation and purification of organic compounds difficult (topic 2), while about 10% of the students perceived the topic difficult to learn (fig 1) this was observed in the study of Davis (nd) with Ghanaian Senior Secondary Students.

## **DISCUSSION**

An adage of Ogba culture in Rivers State of Nigeria has it that “the eye knows the quantity of food that will satisfy the stomach”. It implies that the eye works with the memory of the individual. It follows that the memory can assimilate and accommodate what the eye is seeing. For a learner, he/she has to create a space to learn new thing by the eyes sending information to the memory. The study has revealed the topics in organic chemistry that the students express difficulty in learning. To

be specific over 20% of the students indicated that such topics as laboratory detection of alkynes, structure and properties of benzene posed difficulty to learn to the students. It will not be enough to merely consider the topics the way they are. It is important to ask; what makes the topics difficult to learn for the students? The content and structure are two important factors that are likely to contribute to the phobia of the students in learning. How do the students chunk these topics to make it easy for them to learn? The teacher seems to be teaching their topics without the students learning. The teacher has the required chunking that makes his strategy to learn the topics definite and so does not experience difficulty (see Table 1 and Fig 1). The teacher does not seem to have successfully extended this strategy to the students and so they (students) experience difficulty where the teachers do not experience difficulty.

Organic chemistry can appear unattractive to some students at first glance. The terminology it uses can make some see it as a difficult section of chemistry to understand. Fears of the subject area can then be compounded by the complexity of some organic compounds.

Organic chemistry concepts are interrelated. At the level the students were, they should have the sufficient pre-requisite knowledge to tackle any aspect of organic chemistry. The students simply see some organic chemistry topics as difficult. The teachers as masters do not reasons along with the students. It was only in topic 2 – separation and purification that the teachers actually perceived the difficulty of the students. This aspect of chemistry involves knowledge of chromatography and

involves the use of spectrometer in case of determining the purity of organic substances. This could be the source of difficulty of the students.

Generally, the students' difficulty in other topics could be linked to the nature of organic compounds, electric configuration of carbon and mechanistic approach by students. All these have implications for learning organic chemistry concepts.

Students need to visualise organic chemistry compounds from 3D point which poses problem so they resort to rote learning which is not meaningful and cannot be applied in novel situations. The terminology we use can be a barrier to learning as students struggle with a whole new 'language' of specific terms.

The teacher must do something to help the students. It is suggested that the teacher should go back to his scheme of work and restructure it. This means that the teacher can consider reducing the size of the topics without watering down content. The students can develop their chunks within their memory capacity as "visualized" by their eyes. This is likely to remove the phobia of learning organic chemistry concepts.

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