

## THE DIFFERENTIAL PERCEPTIONS OF SELECTED GHANAIAN SENIOR HIGH SCHOOL (SHS) STUDENTS AND TEACHERS ABOUT ORGANIC CHEMISTRY

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### ABSTRACT

The purpose of the study was to determine the perceptions that senior high school chemistry students and teachers have about organic chemistry as well as to compare organic chemistry topics that are difficult for students and teachers. Simple random sampling (lottery) and purposive sampling methods were used to select a sample of hundred (100) students who studied elective chemistry and ten (10) chemistry teachers. The research instruments used to collect data for this study were the organic chemistry perceptions questionnaire for students (OCPQS) and organic chemistry perceptions questionnaire for teachers (OCPQT). Descriptive statistics (frequencies and percentages) were used to analyze the data collected. The findings revealed that high school students have a fairly positive perception of organic chemistry while the teachers had a highly positive perception of organic chemistry. Preparation and chemical reactions of alkenes, preparation and chemical reactions of alkynes, structure and stability of benzene, reactions of benzene, comparison of reactions of benzene and alkenes, petroleum, polymers and naming of alkanes and structural isomerism were perceived by students as difficult to understand. The rest of the Ghanaian high school organic chemistry topics (26 out of 34 topics) were perceived as easy to understand by students. The teachers also perceived all the organic chemistry topics as easy to teach with the exception of reactions of benzene. It was suggested among others that teachers should use varied methods to teach organic chemistry topics to facilitate easy understanding by students. [*African Journal of Chemical Education—AJCE 11(2), July 2021*]

## INTRODUCTION

At a symposium organized by the American Chemical Society in 2016, many of the speakers who were educators agreed that organic chemistry has always been in crisis and that students have been saying that organic chemistry is difficult for a long time [10]. A search through available literature has further revealed that a lot of researchers [5, 15, 16, 21] have identified organic chemistry as one of the most difficult topics in chemistry. Topics such as petroleum, natural and synthetic polymers [9, 25], differentiating of functional groups [4,19], benzene [9], drawing and representation of organic compounds [16, 23], isomerism [22], properties of organic compounds [3], aromatic hydrocarbons [7], and classification of organic compounds [8,14] have been listed as difficult for students and teachers by the various researchers.

[11,12] also identified that the inability of Ghanaian students to understand the nature of matter and connect among the three representational levels of matter (macroscopic, microscopic and representational) are the main factors that impede their study of chemistry. According to [13], students are most of the time unable to understand these representations very well and thus form faulty and weak basis for further study of chemical concepts, especially in organic chemistry. [1] also carried out studies on students' conceptions and performance in IUPAC nomenclature of organic compounds and found that Ghanaian high school students had weak performance in naming and writing structural formulae of alkenes, alkynes, alkanols, alkanolic acids and alkyl alkanoates. Further studies by [2] showed that students' difficulties in IUPAC naming of organic compounds included their inability to identify the correct number of carbon atoms in the parent chain, and to identify a substituent or functional group. Similar studies by [7] and [9] revealed that high school students perceived classification of organic compounds and petroleum as difficult to understand while their teachers did not perceive any of the Ghanaian high school organic chemistry

topics as difficult to teach. To remediate the students' difficulties, [12, 13] suggested that teachers could use concrete examples to enable students to form mental models in order to alleviate the abstractness of chemical concepts and to begin their lessons by asking questions related to everyday life events so that the context of the properties or answers could be steered to the classroom and its scientific or chemical aspect emphasized through individual, small group and whole class discussions.

Despite the efforts by teachers, students and chemical education researchers in Ghana to improve the performance of students in organic chemistry, the main body in charge of Ghanaian senior high school examinations (West African Examinations Council, WAEC) consistently reports poor performance of students in organic chemistry. Recent WAEC chief examiners' reports on chemistry [26, 27] pointed out that the students showed the following weaknesses: inability to recall the terms such as catalytic cracking, functional groups, aliphatic compounds, aromatic compounds, inability to draw structures of organic compounds indicating all bonds and drawing how the carbon-carbon double bonds in alkenes are formed. These suggest that students had problems with learning organic chemistry.

In teaching organic chemistry, it is critical that educators are aware of the cognitive level and ability of their learners, if not learners will be overwhelmed by the multi-level cognitive demands of chemistry as well as the other scientific and mathematical demands of the subject [19]. This is because what might be easy for a teacher to understand might not be easy for a student to understand due to their differences in experiences and cognitive abilities. It is, therefore, important that teachers are made aware of their learners' attitudes, preconceptions and perceptions so that they will be able to tailor their instructions to ensure meaningful learning as students' attitudes and

perceptions about a subject can in the long run influence their performance in that subject. In this study, the perceptions of senior high school (SHS) students and teachers about organic chemistry as well as difficult topics in organic chemistry for students and teachers are evaluated and compared descriptively. This study therefore sought to:

1. evaluate selected SHS students' and teachers' perceptions about organic chemistry
2. compare students' difficult organic chemistry topics to teachers' difficult organic chemistry topics
3. Take suggestions from students and teachers on how to improve the teaching and learning of organic chemistry

Based on the specific objectives stated above, the following research questions were formulated to guide this study.

1. What are the SHS students' and teachers' perceptions of organic chemistry?
2. Which are the differences and similarities in organic chemistry topics that students and teachers perceive to be difficult?
3. What suggestions do students and teachers have to improve the teaching and learning of organic chemistry?

## **DESIGN AND PROCEDURES**

The study, which used a descriptive survey design, involved a hundred (100) third year senior high school general science students and 10 elective chemistry teachers from three selected schools in the central region of Ghana. The student and teacher participants were from all over the country and had converged at the three selected schools and had either been taught or tutored organic chemistry. The sample were required to indicate on a five point likert scale their level of

agreement to statements that sought to evaluate their perceptions about organic chemistry. They were further asked to indicate on a six point Likert scale the level of difficulty posed by organic chemistry topics in the Ghanaian senior high school chemistry syllabus. The responses to the questionnaire items were then summarised into frequencies and percentages and discussed.

## ANALYSIS OF RESULTS AND DISCUSSIONS

Presented in Table 1 is a summary of students' responses to statements in section B of the OCPQS which sought information on students' general perceptions of organic chemistry as a subject. Students were asked to indicate their level of agreement or disagreement to statements on a five-point likert scale which sought to seek their general attitudes and perceptions of organic chemistry. The five point scale was then collapsed to three with 'strongly agree' and 'agree' grouped as 'agree' and 'strongly disagree' and 'disagree' grouped as disagree, while the 'undecided' slot was not collapsed.

**Table 1: Students' General Perceptions of Organic Chemistry**

No.	STATEMENT	%	%	%
		AGREE	UNDECIDED	DISAGREE
1.	Organic chemistry is a difficult topic for me	45.0	7.0	48.0
2.	It is easy to solve organic chemistry problems	54.0	10.0	36.0
3.	I am very happy during organic chemistry lessons	63.6	7.1	29.3
4.	Organic chemistry concepts are very easy to understand	51.0	7.0	42.0
5.	My chemistry teacher's method of teaching helped me to understand organic chemistry concepts well	58.60	15.10	26.30
6.	Organic chemistry is interesting	64.60	15.10	26.30
7.	I enjoy learning organic chemistry more than the other aspects of chemistry	29.30	11.10	59.60

Source: Field data, 2019

From Table 1, it can be seen that a considerable number of students (45) representing 45.0% of the student sample agreed that organic chemistry was a difficult subject for them while 48

students (48.0%) disagreed. Although a simple majority disagreed that organic chemistry was difficult, the difference between the number of students who agreed and those who disagreed was not large so it could be inferred that almost half of the student sample saw organic chemistry as difficult while the other half saw it as not difficult. This is in contrast to findings from a study on Irish high school learners and teachers' perceptions and perspectives of organic chemistry by [19] which revealed that less than one third (75, 27.5%) of the high school learners they studied found organic chemistry easy while 165 (59.8%) of the learners found organic chemistry difficult to learn. In the current study, about 51% of the students agreed that organic chemistry concepts were very easy to understand, 54% found it easy to solve organic chemistry problems, 63% were happy during organic chemistry lessons, 58% agreed that their chemistry teacher's method of teaching helped them to understand organic chemistry concepts well, while 64% found organic chemistry interesting. However, 59% disagreed with the statement 'I enjoy learning organic chemistry more than the other aspects of elective chemistry' while only 29% agreed to it. It could be inferred that if given the choice, majority (59%) of these students would choose to read the other aspects of chemistry over organic chemistry. Generally, it could be said that students have a fairly positive perception of organic chemistry and a positive attitude towards it but would not choose to study organic chemistry over the other aspects of chemistry if given the chance.

Table 2 presents a summary of teachers' responses to statements in section B of the OCPQT which sought information on teachers' general perceptions of organic chemistry as a subject. Students and teachers were asked to indicate their level of agreement or disagreement to statements on a five-point Likert scale. The five-point scale was then collapsed to three with 'strongly agree' and 'agree' grouped as 'agree' and 'strongly disagree' and 'disagree' grouped as disagree, while the 'undecided' slot was not collapsed.

**Table 2: Teachers' General Perceptions of Organic Chemistry**

No.	STATEMENT	AGREE (%)	UNDECIDED (%)	DISAGREE (%)
1.	Organic chemistry is a difficult topic for me to teach	0.0	0.0	100.0
2.	Organic chemistry concepts are very easy to understand	80.0	0.0	20.0
3.	It is easy to solve organic chemistry problems	66.7	0.0	33.3
4.	I enjoy teaching organic chemistry more than other aspects of chemistry	70.0	10.0	20.0
5.	Organic chemistry topics are <b>not</b> interesting	10.0	20.0	70.0

Source: Field data, 2019

On other hand, it can be seen from Table 2 that all the teachers (100%) disagreed with the statement ‘organic chemistry is a difficult subject for me’, meaning that all the teachers viewed organic chemistry as an easy subject. Eight of the teachers (representing 80%) agreed that organic chemistry concepts are very easy to understand while two of them (20%) disagreed with this statement. Six teachers agreed that it was easy to solve organic chemistry problems, three disagreed, and one teacher did not respond to the statement. Seven of the teachers enjoyed teaching organic chemistry topics more than the other aspects of chemistry while two of them did not enjoy teaching organic chemistry more than the other aspects of chemistry.

When the teachers’ response to this particular statement is compared with that of the students, there seems to be a mismatch between the enthusiasm of teachers about organic chemistry and that of their students. This mismatch could be attributed to the fact that teachers are ‘experts’ while learners are just beginners in organic chemistry. Also, 7 teachers disagreed to the statement ‘organic chemistry topics are not interesting’ while 1 agreed. Unlike the students who perceived organic chemistry as interesting but would choose the other aspects of chemistry over organic chemistry, the teachers perceived organic chemistry as easy and interesting and would choose to teach organic chemistry over the other aspects of chemistry.

The summary of responses of students to the levels of difficulty posed by listed Ghanaian SHS organic chemistry topics are presented in Table 3. Students were asked to indicate on a six-point Likert scale (from 'very easy to understand' to 'not taught') the levels of difficulty of the listed organic chemistry topics. Before analysis, the 6 point Likert scale in the students' questionnaire was collapsed to 4 with 'very easy to understand' and 'easy to understand' put together as 'easy to understand' and 'difficult to understand' and very 'difficult to understand' grouped as 'difficult to understand'.

**Table 3: Students' Level of Difficulty in Understanding Organic Chemistry Topics**

TOPICS	EU (%)	UCE (%)	DU (%)	NT (%)
1. Bonding in carbon	73.0	14.0	12.0	1.0
2. Classification of organic compounds	67.0	17.0	16.0	0.0
3. Identification of elements in organic compounds	56.0	24.0	20.0	0.0
4. Separation and purification of organic compounds.	54.0	21.0	23.0	1.0
5. Sources and characteristics of alkanes	58.0	18.0	23.0	1.0
6. Naming of alkanes and structural isomerism	65.0	18.0	17.0	0.0
7. Preparation, physical and chemical properties of alkanes	53.0	21.0	24.0	2.0
8. Uses of alkanes	72.0	14.0	12.0	1.0
9. Sources and characteristics of alkenes	57.0	22.0	17.0	3.0
10. Naming of alkenes and isomerism in alkenes	55.0	18.0	24.0	1.0
11. Preparation and chemical reactions of alkenes	37.0	24.0	37.0	1.0
12. Uses of alkenes	59.0	19.0	12.0	10.0
13. Sources and characteristic properties of alkynes	48.0	28.0	22.0	2.0
14. Naming of alkynes and isomerism in alkynes	49.0	24.0	25.0	2.0
15. Preparation and chemical reactions of alkynes	30.0	36.0	29.0	5.0
16. Uses of alkynes	61.0	20.0	15.0	4.0
17. The structure and stability of benzene	35.0	26.0	33.0	6.0
18. Reactions of benzene	33.0	28.0	30.0	9.0
19. Comparison of reactions of benzene and alkenes	29.0	32.0	29.0	10.0
20. Preparation and properties of alkanols	48.0	28.0	18.0	6.0
21. Physical properties of alkanols	57.0	26.0	14.0	3.0
22. Naming of alkanols	60.0	20.0	15.0	5.0
23. Primary, Secondary and tertiary alkanols	59.0	18.0	20.0	3.0
24. Chemical reactions of alkanols	46.0	24.0	25.0	5.0
25. Uses of alkanols	68.0	17.0	9.0	6.0
26. Sources, preparation and properties of alkanolic acids	48.0	29.0	18.0	5.0



27. Naming of alkanolic acids	52.0	22.0	23.0	3.0
28. Uses of alkanolic acids	58.0	27.0	12.0	3.0
29. Sources, preparation and properties of alkyl alkanoates	38.0	25.0	30.0	7.0
30. Naming and structure of alkyl alkanoates	48.0	19.0	29.0	4.0
31. Uses of alkyl alkanoates	42.0	23.0	29.0	6.0
32. Soapy and soapless detergents	39.0	23.0	21.0	17.0
33. Polymers and polymerization	33.0	18.0	25.0	24.0
34. Petroleum	22.0	28.0	23.0	27.0

Source: Field data, 2019

From the summary of responses presented in Table 3, 29 out of the 34 listed topics were viewed by majority of students as easy to understand. The topics which were perceived as difficult to understand by students were preparation and chemical reactions of alkenes, preparation and chemical reactions of alkynes, structure and stability of benzene, reactions of benzene, comparison of reactions of benzene and alkenes.

Preparation and chemical reactions of alkenes was chosen by 37% of students as difficult and the same percentage of students (37%) also choose it as easy to understand. However, 24% of students asserted that they understood it only after considerable effort. If a concept must be understood after considerable effort, then that understanding of that concept poses some level of difficulty and could be said to be fairly difficult. In view of this it could be concluded that preparation and chemical reactions of alkenes was perceived as difficult by the SHS students.

Different reasons could be attributed to the difficulties students face in studying. However, this was not part of the current study. The identified difficulty could also be a teacher factor (teachers' methodologies, punctuality and attendance to class, mastery of content and ability to deliver effectively), students' factor (students' attitude to learning, motivation, attendance to class, paying attention in class), and lack of teaching and learning materials or other extrinsic difficulty; difficulty associated with the subject itself beyond the control of the learner [19].

Comparison of the reactions of benzene and alkenes also had the same percentage (29%) of students choosing 'easy to understand' and 'difficult to understand' respectively while a greater percentage (32%) understood it only after considerable effort. As stated earlier, the fact that considerable effort had to be put in before students understood concepts could mean that some level of difficulty had to be overcome, and therefore, the topic 'comparison of the reactions of benzene and alkenes' could be said to be perceived as difficult to understand by SHS students.

A slightly higher percentage of students viewed the topics 'preparation and chemical reactions of alkynes', 'structure and stability of benzene' and 'reactions of benzene' as easy to understand (30%, 35% and 33% respectively) as compared to those that viewed them as difficult to understand (29%, 33% and 30% respectively). However, an equally appreciable percentage of students (36%, 26% and 28% respectively) also viewed these topics as 'understood only after considerable effort'. If a topic is understood only after considerable effort, then it is difficult to understand [7]. Conclusions could therefore be drawn that these topics were perceived to be difficult by the SHS students.

In addition, the topic on petroleum was viewed by 23% of students to be difficult to understand. About 22% of students saw it as easy to understand while 23% saw it as a topic that could be understood only after considerable effort. This topic also recorded the highest percentage of students (27%) responding to it as 'not taught'. Students' difficulties in understanding 'petroleum' could therefore be attributed to the probability that it was not taught or the other reasons like teacher factors and student factors which have been stated earlier. Seeing that almost the same percentage of students that find petroleum difficult to understand also chose 'not taught', it could be that indeed most teachers did not teach petroleum due to the fact that petroleum is the last topic under organic chemistry in the SHS chemistry syllabus. It being the last topic could imply

that teachers may not get to the topic because of time constraints. Another interpretation of the gathered data or assumption could be that the students were not present in class when ‘petroleum’ was taught or it was taught during extra classes where some of the students missed out. Polymers and polymerization also had quite a large percentage of students (25%) perceiving it as difficult to understand and the second highest percentage of students saying it was not taught (24%).

Furthermore, students were required to list three most difficult topics in organic chemistry in item 35 of the OCPQS. From the responses students provided, the top five most difficult topics for students and their percentages were polymers and polymerization (69%), structure and stability of benzene (65%), reactions of benzene (60%), naming of alkanes and structural isomerism (56%) and petroleum (54%). Comparing the difficult topics stated in Table 3 and those listed above, it could be seen that structure and stability of benzene, reactions of benzene and petroleum appear in both lists and therefore it could be said that they are the top three most perceived difficult to understand topics chosen by the students. Although polymers and polymerization and naming of alkanes and structural isomerism were not chosen by majority of students as difficult to understand in Table 3, they were stated by a large number of students as difficult. In similar research works [7, 4, 19, 25], petroleum, benzene and synthetic polymers were also identified as topics that were perceived as difficult for students to understand.

Table 4 provides a summary of responses of teachers to the levels of difficulty posed by listed Ghanaian SHS organic chemistry topics. Teachers were asked to indicate on a five-point likert scale (from ‘very easy to teach’ to ‘very difficult to teach’) the levels of difficulty of the listed organic chemistry topics. Before analysis, the five point likert scale was collapsed to three with ‘very easy to teach’ and easy to ‘teach’ grouped as ‘easy to teach’, ‘difficult to teach’ and very ‘difficult to teach’ were grouped as ‘difficult to teach’ while ‘not sure’ was not collapsed.

**Table 4: Teachers' Perceptions about Difficulty Levels of Organic Chemistry Topics**

TOPICS	EASY TO TEACH (%)	NOT SURE (%)	DIFFICULT TO TEACH (%)
1. Bonding in carbon	100.0	0.0	0.0
2. Classification of organic compounds	90.0	10.0	0.0
3. Identification of elements in organic compounds	90.0	0.0	10.0
4. Separation and purification of organic compounds, empirical and molecular formulae	90.0	10.0	0.0
5. Sources and characteristics of alkanes	100.0	0.0	0.0
6. Naming of alkanes and structural isomerism	90.0	10.0	0.0
7. Preparation and properties of alkanes	70.0	0.0	30.0
8. Uses of alkanes	90.0	0.0	10.0
9. Sources and characteristics of alkenes	80.0	0.0	20.0
10. Naming of alkenes and isomerism in alkenes	90.0	0.0	10.0
11. Preparation and chemical reactions of alkenes	70.0	0.0	30.0
12. Uses of alkenes	90.0	0.0	10.0
13. Sources and characteristic properties of alkynes	80.0	10.0	10.0
14. Naming of alkynes and isomerism	90.0	0.0	10.0
15. Preparation and chemical reactions of alkynes	60.0	0.0	40.0
16. Uses of alkynes	80.0	10.0	10.0
17. The structure and stability of benzene	60.0	0.0	40.0
18. Reactions of benzene	50.0	0.0	50.0
19. Comparison of reactions of benzene and alkenes	60.0	0.0	40.0
20. Preparation and properties of alkanols	100.0	0.0	0.0
21. Physical properties of alkanols	100.0	0.0	0.0
22. Naming of alkanols	90.0	10.0	0.0
23. Primary, Secondary and tertiary alkanols	90.0	0.0	10.0
24. Chemical reactions of alkanols	80.0	0.0	20.0
25. Uses of alkanols	100.0	0.0	0.0
26. Sources and properties of alkanolic acids	90.0	0.0	10.0
27. Naming of alkanolic acids	100.0	0.0	0.0
28. Uses of alkanolic acids	100.0	0.0	0.0
29. Sources and properties of alkyl alkanoates	80.0	10.0	10.0
30. Naming and structure of alkyl alkanoates	90.0	0.0	10.0
31. Uses of alkyl alkanoates	90.0	0.0	10.0
32. Soapy and soapless detergents	80.0	0.0	20.0
33. Polymers and polymerization	50.0	10.0	40.0
34. Petroleum	70.0	0.0	30.0

Source: Field data, 2019

Comparatively, it can be seen from Table 4 that teachers generally perceived all organic chemistry topics as easy to teach with the exception of reactions of benzene. This agrees with

findings from [9] who also stated that chemistry teachers perceived none of the SHS organic chemistry topics as difficult to teach. It is however important to note that the fact that teachers rate a topic as easy to teach does not mean it is best taught (taught well) neither does a teacher rating a topic as difficult to teach make that topic the most poorly taught topic (not well taught) as these results are only representative of the teachers' views [19]. This means that a topic could be rated as easiest to teach by teachers but may end up not being well taught and a topic rated most difficult to teach might end up being well taught by a teacher. Teachers may be able to teach these topics to the understanding of their students or not.

The few topics which recorded an appreciable number of teachers viewing them as difficult to teach are identified below. The following topics were perceived as difficult to teach by at least 40% of the teachers: preparation and chemical reactions of alkynes (40%), the structure and stability of benzene (40%), reactions of benzene (50%), comparison of reactions of benzene and alkenes (40%), and polymers and polymerization (40%). A lot of factors could contribute to a teacher's difficulty in teaching a particular topic. Some of the factors may be the extensive nature of the content (loaded content), high cognitive demand of the content, lack of teaching and learning materials like textbooks, laboratory equipment and lack of mastery over the content by the teacher [18].

### **Suggestions from students and teachers for making organic chemistry in senior high schools meaningful and interesting**

An open ended item in section C of both the OCPQT and OCPQS asked respondents to write what they thought should be done to make teaching and learning of SHS organic chemistry more

meaningful and interesting. The varied responses to this item was coded and put into themes. These have been discussed below.

1. Using varied teaching methodologies

Many teachers and students recommended that instead of teachers using only the lecture method in teaching organic chemistry, teachers should look at using more of demonstrations, practical work in the laboratory, letting students use molecular models, computer simulations and using audio visuals in their teaching. These methods when used, will facilitate students' understanding of concepts and help them remember what has been taught better than if only the lecture method is used. [6] and [20] have confirmed that conducting experimental activities and using computer simulations to teach help in developing positive students' attitudes in learning chemistry and enhancing achievement in chemistry. Practical work needs to essentially be about stimulating and challenging students to think and understand the relation between evidence and theory [28] and students who learn by these inquiry approaches are responsible for developing their own answers to questions rather than exclusively relying on the teacher and or textbooks [17].

2. Provision of more textbooks

Participants suggested that more elective chemistry textbooks with content on organic chemistry be provided to students. This would ensure that students would have easy access to textbooks and will not have to depend only on the notes given to them by teachers. Students can then read wider on topics and get exposed to more examples than what is given in class. This may go a long way to help students especially if they are able to read ahead before going to class to understand what is taught in class better.

3. Solving of more examples and prompt feedback

Students suggested that teachers should solve more problems on organic chemistry with them in class rather than just giving of notes and explanations. In solving examples in class, students are exposed to possible examination questions and also learn how to solve problems/ answer organic chemistry questions. Students also suggested that whenever assignments are given, teachers should do well to provide prompt feedback. This would help students see how they are performing, see their mistakes and correct them with the help of teachers.

4. Adapting content to students' cognitive abilities and use of appropriate language level

What may be easy for teachers to understand may not be easy for students to understand because of their differences in cognitive abilities. Although the content of the chemistry curriculum has been designed with students' age and cognitive abilities in mind, it is important that in explaining concepts, teachers adapt the content to suit their students cognitive ability and to the understanding of the average student. The students in this study suggested that their teachers should teach so that the average performing students in the class understand. Also, with English language as the medium of instruction and chemistry having its own language, students suggested that if possible, teachers should break down the "scientific" language to their level of understanding, preferably in the local language.

5. Relating content to real world situations

Many students stated that they could not see the link between what they are being taught in class and the real world situations and would appreciate the subject better if they could see the application to real world situations. As much as possible, teachers should try and point out real life applications of what they teach to students. In view of this both teachers

and students suggested that field trips to chemical industries, especially, those that deal with the application of organic chemistry like soap production companies, oil refineries, etc. be organized.

#### 6. Duration for tuition of content

Teachers and students were also of the view that because of the extensive content of the SHS organic chemistry topics, the teaching and learning of organic chemistry should be spread throughout the three year duration of senior high school rather than teaching it in SHS 3 as stipulated in the SHS chemistry syllabus. Some were even of the view that if possible, organic chemistry should be separated from the other aspects of chemistry in the SHS curriculum and treated as a subject on its own due to its loaded content.

#### 7. Time of day for teaching organic chemistry

Students suggested that chemistry should be taught in the morning when their minds are well rested and fresh rather than in the afternoons when they might be exhausted because of the high cognitive demand the subject places on them.

Similar suggestions were given by teachers and students in a study by [24] who also suggested the provision of more teaching and learning aids, more practical activities, improvement in assessment, use of appropriate English language by teachers and paying attention to more challenging topics as ways of improving students' learning in chemistry.

## CONCLUSIONS

This study was aimed at finding the differential perceptions of selected SHS teachers and students. The study specifically considered the general perceptions of students and teachers in selected senior high schools in Ghana about organic chemistry. It perused the topics that students



and teachers considered easy or difficult to understand and teach (for teachers), and sought suggestions on how to improve the teaching and learning of organic chemistry in senior high schools. Findings revealed that the SHS teachers had a positive perception of organic chemistry and found 33 out of the 34 organic chemistry topics in the SHS chemistry syllabus easy to teach. Reactions of benzene of benzene was the only topic that 50% of the teachers found easy to teach while the other 50% found it difficult to teach. The students on the other hand also had a positive perception towards organic chemistry but would be interested in studying the other aspects of chemistry rather than organic chemistry. Students found 26 out of the 34 organic chemistry topics as easy to understand. The topics that the students perceived to be difficult to understand were preparation and chemical reactions of alkenes, preparation and chemical reactions of alkynes, structure and stability of benzene, reactions of benzene, comparison of reactions of benzene and alkenes, petroleum, polymers and naming of alkanes and structural isomerism). Their SHS teachers also perceived polymers and polymerization, petroleum, reactions of alkanes and reactions of alkenes to be difficult for their students to understand. Students and teachers suggested that using varied methodologies to teach, provision of more textbooks, teachers solving more examples with students and giving prompt feedbacks, relating content to real life situations and increasing the duration of teaching organic chemistry among others could help improve perceptions and consequently make the teaching and learning of organic chemistry more meaningful and interesting.

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