JPPIPA 10(6) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Analysis of Understanding the Concept of Alkenes through the Three-tier Multiple Choice Diagnostic Test Instrument

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Received: December 11, 2023
Revised: May 8, 2024
Accepted: June 25, 2024
Published: June 30, 2024

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DOI: 10.29303/jppipa.v10i6.6510

Abstract: The ability of prospective teacher students to master chemistry material will influence the achievement of learning objectives. Alkenes are an important sub material in organic chemistry courses because alkenes are often used as basic ingredients in chemical reactions. This research aims to analyze Untan chemistry education students' understanding of alkene sub materials. The research method used is quantitative descriptive. The research sample consisted of 50 students. The instrument used was Three-Tier Multiple Choice with a total of 10 questions and a semi-structured interview. Before using the instrument, a validity and reliability test was carried out first. The analysis results of students who understand the concept well are only 28.06%, and 6.06% of students understand but are not sure, while the percentage of students who do not understand the concept is 40.21%, and 29.95% of students experience misconceptions.

Keywords: Alkenes; Concept understanding; Diagnostic test; Three-tier multiple choice

Introduction

Understanding concepts is students' ability to explain part of the material or all of the material in their own language (Alighiri et al., 2018). Students are considered to understand a concept if the student is able to explain what they have heard and read in their own sentences, and can provide other examples than those that have been demonstrated (Laila et al., 2018). Understanding the concept of students as prospective educators in mastering chemistry learning concepts can influence the achievement of learning objectives (Sitinjak, 2021). Research conducted Karini et al. (2022) towards students of the Chemistry Education Study Program FKIP Tanjungpura University (Untan) showed that the material in the Organic Chemistry course was classified into the categories very difficult (5.88%), difficult (34.32%), and quite difficult (57.84 %). Meanwhile, literature searches show that the level of conceptual understanding possessed by students is still low and many of them experience misconceptions in learning functional groups in organic chemistry courses (Akkuzu et al., 2016).

In research Djarwo et al. (2023), the level of understanding of Chemistry Education students at Cenderawasih University Jayapura shows that understanding of hydrocarbon material is still low, with the classification of understanding the concept (12.25%), misconceptions (26.72%), and not understanding the concept (61.03%). Comparison of mid-semester exam (UTS) score data for monofunctional organic compound chemistry in the Untan Chemistry Education Study Program for the last three years, namely 2019, 2020 and 2021, shows that there is a gap in the achievement of learning outcomes in the monofunctional compound organic chemistry course. As many as 4.16% of students from the class of 2019 got a score of <70, while the number of students who got a score of <70 in the classes of 2020 and 2021 increased drastically, namely 90.19% and 72.41% respectively. A score of 70 is used as a reference because achieving a score of 70 is categorized as good in the curriculum of the Chemistry Education Study Program, Tanjungpura University.

How to Cite:
Selina, S., Muharini, R., Lestari, I., Masriani, M., & Rasmawan, R. (2024). Analysis of Understanding the Concept of Alkenes through the Three-tier Multiple Choice Diagnostic Test Instrument. *Jurnal Penelitian Pendidikan IPA*, *10*(6), 3463–3472. https://doi.org/10.29303/jppipa.v10i6.6510

Alkenes are an important sub material in organic chemistry courses because alkenes are hydrocarbon compounds which are often used as precursors in organic chemical reactions. In the monofunctional compound organic chemistry (KOSMO) course, this sub-material is studied before the mid-semester exam (UTS). The concept studied in the alkene sub-material consists of six indicators as stated in the semester learning plan instrument (RPS) of lecturers teaching organic chemistry courses on monofunctional compounds, namely alkenes in everyday life, alkene molecular formulas, alkene structures, alkene nomenclature based on IUPAC rules, physical and chemical properties of alkenes, as well as reactions to make alkenes.

Pre-research results in the form of analysis of students' UTS answers and interviews showed that many students' answers were wrong and inaccurate. On the question regarding naming alkene compounds based on IUPAC rules, only 1 person out of 58 students answered correctly. The students made mistakes in carbon chain numbering and the rules for naming alkene carbon chains. In questions relating to Markovnikov reactions, the answer errors lie in writing the reaction mechanism, determining the main product, and giving the name of the compound product. These errors and mistakes can be caused by students' low understanding of the concept of alkenes. Thus, Untan Chemistry Education students' understanding of the concepts regarding alkene submaterials needs to be analyzed further.

A literature search shows previous research related to understanding the concept of alkenes. Study (Purwanto, 2021b) Regarding students' understanding of the concept of alkenes, it shows that students have difficulty with alkene compounds (25.00%), examples of alkene compounds (33.33%), nomenclature of alkene compounds based on IUPAC rules (45.83%), naming alkene compounds based on IUPAC rules (37.50%), chemical reactions in alkene compounds (25.00%), and uses of alkene and alkyne compounds (37.50%). (Purwanto, 2021a) also reported the difficulties of students from the Chemistry Education Study Program, FKIP, Billfath University in determining cis and trans isomerism in alkene compounds which have a complex structure of 14%, and E-Z isomery (43%). Students (71%) also had difficulty understanding reactions in alkenes, especially the concepts of Markovnikov and anti-Markovnikov rules. However, previous studies have not examined the understanding of the concept of alkenes in everyday life, the molecular formula of alkenes, the structure of alkenes, the nomenclature of alkenes based on IUPAC rules, the physical and chemical properties of alkenes, as well as the reactions for making alkenes through diagnostic tests.

In this research, analysis of understanding of the concept of alkenes was carried out on Untan chemistry education students through a three-tier multiple choice diagnostic test. The aim of the research is to classify and describe the level of students' understanding of the concept of alkenes in six alkene sub materials. The results of the research are expected to contribute to improving models and appropriate learning strategies for organic chemistry courses on monofunctional compounds, especially on alkene sub materials.

Method

Research Design

The type of research used in this research is quantitative descriptive, which aims to describe students' understanding of alkene material. According to Godwin et al. (2021), Quantitative method is a research method for examining a certain population or sample based on positivism. Data collection uses research instruments, and data analysis is quantitative.

Research Targets

The population in this study were active Untan Chemistry Education students, namely students from the classes of 2020, 2021, and 2022. The samples in this study had the same characteristics, namely that they had both taken the KOSMO course and had studied alkene submaterials. Sample selection was carried out using a cluster random sampling technique. Samples were taken from each class based on alkene scores on UTS at high, medium and low levels, and totaled 50 students.

Research Data

This research uses quantitative data as main data and qualitative data as supporting data. Quantitative data is data that can be directly calculated or measured, in the form of explanations or information presented in the form of numbers or numbers. Qualitative data is research data in the form of words or writing, images and recordings which are the result of interviews (Busetto et al., 2020). Quantitative data was obtained from the analysis of answers to the Three-Tier Multiple Choice Diagnostic test with 10 questions and qualitative data was obtained from the results of semi-structured interviews.

Research Instrument

The instruments used in this research are modifications of the Three-Tier Multiple Choice Diagnostic test and interviews. Diagnostic tests in the form of Three-Tier instruments can identify students' level of conceptual understanding (Anintia et al., 2017). The instrument used consisted of 10 questions which were created based on six indicators of alkene

submaterials, namely alkenes in everyday life, alkene molecular formulas, alkene structures, alkene nomenclature based on IUPAC rules, physical and chemical properties of alkenes, and alkene production reactions. The test instrument consists of 3 parts, the first part is questions with answer choices (multiple choice), the second part is the reason for choosing an answer in closed form (multiple choice) and the third part contains the level of confidence (Lestari, 2021).

The level of confidence uses the CRI (Certainty of Response Index) technique which has been developed by Alfiah N et al. (2020), which consists of a scale of 0 to 5. Interviews were conducted to obtain in-depth information from students. The indicators in the interview guide include the level of difficulty, understanding, and level of student confidence. The interview used is a semi-structured interview in order to solve a problem more openly, where the resource person is asked for his opinion and ideas. Good test questions and interview guidelines must be validated first (Utomo, 2019). The questions and interview guidelines that were created were validated by three experts.

The aspects of the questions that were validated were the language aspect and the material aspect, while the aspects in the interview guide included the language aspect and the suitability of the questions to the purpose of the interview. The validity results from the validators are calculated using the Aiken formula with the help of Microsoft Excel with the following formula:

$$v = \frac{\sum s}{n(c-1)} \quad (1)$$

Where s is r – lo, where r is the number given by the appraiser, lo is the lowest assessment number, c is the highest assessment number, and n is the number of appraisers (Hendryadi, 2017). The validity result for the diagnostic test questions is 0.8 which means very high, then the validity value for the interview guide is 0.85 which is a very high criterion so that the diagnostic test questions and interview guide are very suitable for use.

After calculating the validity results, a reliability test was then carried out on 20 Untan Chemistry Education students. Calculations are carried out using the KR20 formula because this research instrument only has one correct answer, and the instrument cannot ensure that the level of difficulty of each item is the same, so the KR 20 formula is used. The KR 20 formula is:

$$ri = \frac{k}{k-1}\left\{\frac{st^2-\sum pi.qi}{st^2}\right\} \quad (2)$$

Where k is the number of questions in the instrument, pi is the proportion of subjects who answered correctly, qi is 1 – pi, and st2 is the total variance. The reliability test results obtained were 0.71. An instrument is reliable if the KR reliability coefficient value is more than 0.70 (ri > 0.70).

Data Analysis

Data analysis of each level of student understanding of concepts carried out in this research is displayed in percentage form. Student understanding data was obtained from the results of the Three-Tier Multiple Choice Diagnostic test. The data analysis steps carried out started by examining the respondents' Three-Tier Multiple Choice Diagnostic test answers in the first and second charts. In the third chart, the respondent's level of confidence in choosing an answer is measured. To classify students into understanding the concept well, not understanding the concept, understanding but not sure and misconceptions, a technique for measuring student confidence in answering each question, namely using the CRI (Certainty of Response Index) method, was used. The level of student confidence is reflected in the scale given in each question (A'yun et al., 2018). The CRI confidence level is shown in Table 1.

Table 1. CRI Confidence Level

Scale	Criteria
0	Guessing: if the respondent answers the question 100% by guessing
1	Almost guessed: if the respondent answered the question 75% - 99% by guessing
2	Not sure: if the respondent answered the question 50% - 74% by guessing
3	Confident: if 25% - 49% of respondents answered questions by guessing
4	Almost certain: if respondents answer questions 1% - 24% by guessing

To classify student answers in each category of conceptual understanding based on Three-tier multiple choices with a modified CRI index based on research, it can be seen in Table 2.

Table 2. Classification of Concept Understanding Categories with Modified CRI

Answer	Reason	CRI Index	Information
Correct	Correct	> 2.50	Understand the concept well
Correct	Correct	< 2.50	Understand but not sure
Correct	Wrong	> 2.50	Misconceptions
Correct	Wrong	< 2.50	Don't understand the concept
Wrong	Correct	> 2.50	Misconceptions
Wrong	Correct	< 2.50	Don't understand the concept
Wrong	Wrong	> 2.50	Misconceptions
Wrong	Wrong	< 2.50	Don't understand the concept

Result and Discussion

The Three Tier Multiple Choice modified diagnostic test questions consist of 10 questions which were developed based on six indicators of achievement in the organic chemistry course on alkene sub materials, namely; Able to explain alkenes in everyday life, Able to write down the molecular formula of alkenes, Able to describe the structure of alkenes, Able to name alkenes, Able to explain the physical and chemical properties of alkenes, Able to explain the reaction of making alkenes. The interview guide developed was also based on six indicators of achievement in organic chemistry courses on alkene sub materials.

Overall Student Understanding

Based on the results of the analysis of student answers, data on overall student understanding was obtained which aims to analyze Untan Chemistry Education students' understanding of alkene sub materials. The overall data shows that there are students who understand the concept well, understand but are not sure, have misconceptions and do not understand the concept shown in Figure 1.

Figure 1 shows that there are still many students who do not understand the concept of alkene sub materials compared to other categories. Not understanding the concept occurs when a student answers the questions and reasons incorrectly or one of them is correct but the level of confidence is at an index of 0, 1, and 2, which means the student is guessing or is hesitant in choosing the answer. Based on the results of the interview, students did not understand the concept because students did not pay close attention during the learning process, and did not repeat the material again outside of learning hours, so that when applying it in answering questions, many students did not understand the concept. Students are used to rarely having to repeat learning material again at home, and students have the habit of memorizing and only remembering part of the concept, not the whole concept.

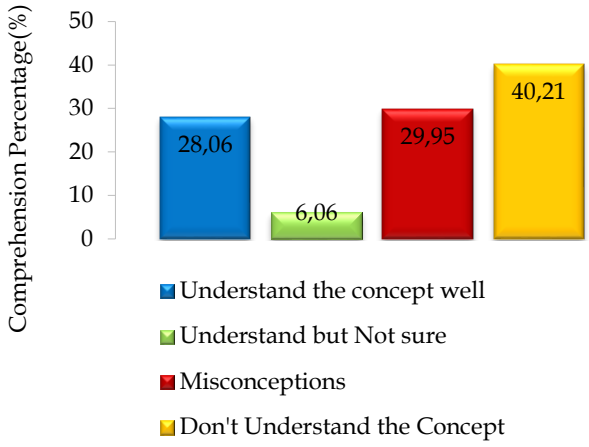


Figure 1. Categories of overall student understanding of alkene sub materials

Table 3. Categories of Student Understanding for Each Indicator

Indicator	Understand the Concept Well %	Understand but Not Sure%	Misconceptions (%)	Don't Understand the Concept (%)
Able to explain alkenes in everyday life	26	12	40	22
Be able to write the molecular formula of alkenes	60	6	26	8
Be able to describe the structure of alkenes	22	4	40	34
Can name alkenes	25	3	31	46.25
Be able to explain the physical and chemical properties of alkenes	23.33	7.33	22.67	46.67
Be able to explain the reaction of making alkenes	12	4	20	64

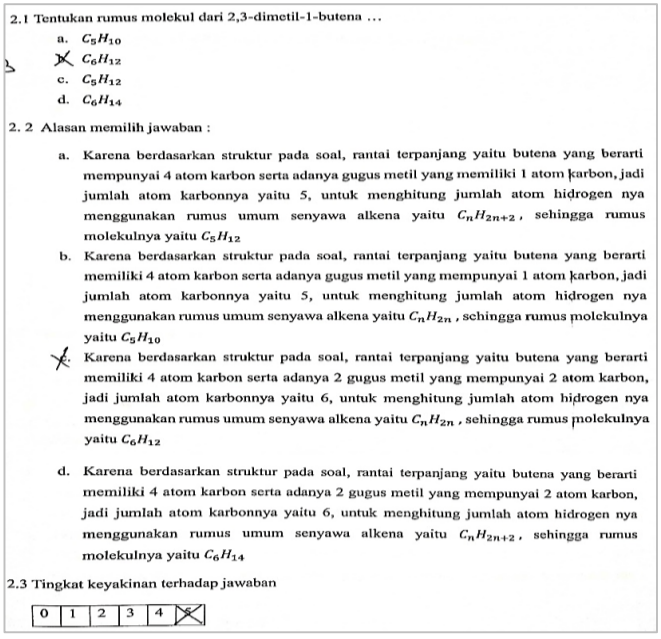
Students also experience misconceptions about alkene sub materials. Misconceptions are differences in concepts that have been understood by someone with concepts that have been determined by experts or can also be interpreted as concepts that are understood being different from the actual concepts (Elvinawati et al., 2022). Students can experience misconceptions due to inappropriate reasoning, making preconceptions, associative thinking, and can also be caused by wrong intuition. Misconceptions that occurred in this research were caused by students who were very confident in the answer even though the answer was wrong. The level of confidence in the misconception category was on a scale of 3, 4, and 5, which means they were sure or even very confident about the answer. On the other hand, students who answer questions incorrectly and are hesitant about the answer do not mean that the student has misconceptions but a lack of knowledge or does not understand the concept (Nurhayati et al., 2019).

The percentage of students who understand the concept well in the alkene sub material is lower than the percentage in the category of not understanding the concept and misconceptions. Students are said to have a good understanding of concepts if in answering the questions and reasons the student answers correctly and has a high level of confidence in the answer, however there are still some students who have answered the questions and reasons correctly but feel doubtful about

the answer or are not sure. The student chose the CRI level on a scale of 0, 1, and 2. Based on the interview, the student was not sure about the answer because the student felt deceived by the other choices and had a habit of memorizing the material so that there was some forgotten material which made the student not sure about the answer, so The student was categorized as understanding the concept but not sure. This can occur due to a feeling of doubt or uncertainty about the reasons students choose to answer questions. Understanding concepts that are not yet comprehensive and only understanding some concepts can cause doubt about the answer.

Understand the Concept

In Table 3, more than half of the students understand the concept well of the alkene molecular formula. Students are asked to determine the molecular formula of 2,3-dimethyl-1-butene. Based on the results of the analysis of answers, students can determine the alkene molecular formula correctly and choose the right reason and be confident in the answer. Students answer the questions correctly because students can describe or imagine the structural form of the compound and students know the general formula for alkene compounds, the general formula for alkene compounds is CnH2n. Students are said to understand concepts well if the concepts understood by students are in accordance with the concepts conveyed by experts. Examples of answers from students who understand the concept well of indicators that are able to write down alkene molecular formulas are shown in Figure 2.


2.1 Tentukan rumus molekul dari 2,3-dimetil-1-butena ...

a. C_5H_{10}
b. C_6H_{12}
c. C_5H_{12}
d. C_6H_{14}

2. 2 Alasan memilih jawaban :

a. Karena berdasarkan struktur pada soal, rantai terpanjang yaitu butena yang berarti mempunyai 4 atom karbon serta adanya gugus metil yang memiliki 1 atom karbon, jadi jumlah atom karbonnya yaitu 5, untuk menghitung jumlah atom hidrogen nya menggunakan rumus umum senyawa alkena yaitu C_nH_{2n+2}, sehingga rumus molekulnya yaitu C_5H_{12}

b. Karena berdasarkan struktur pada soal, rantai terpanjang yaitu butena yang berarti memiliki 4 atom karbon serta adanya gugus metil yang mempunyai 1 atom karbon, jadi jumlah atom karbonnya yaitu 5, untuk menghitung jumlah atom hidrogen nya menggunakan rumus umum senyawa alkena yaitu C_nH_{2n}, schingga rumus molekulnya yaitu C_5H_{10}

c. Karena berdasarkan struktur pada soal, rantai terpanjang yaitu butena yang berarti memiliki 4 atom karbon serta adanya 2 gugus metil yang mempunyai 2 atom karbon, jadi jumlah atom karbonnya yaitu 6, untuk menghitung jumlah atom hidrogen nya menggunakan rumus umum senyawa alkena yaitu C_nH_{2n}, sehingga rumus molekulnya yaitu C_6H_{12}

d. Karena berdasarkan struktur pada soal, rantai terpanjang yaitu butena yang berarti memiliki 4 atom karbon serta adanya 2 gugus metil yang mempunyai 2 atom karbon, jadi jumlah atom karbonnya yaitu 6, untuk menghitung jumlah atom hidrogen nya menggunakan rumus umum senyawa alkena yaitu C_nH_{2n+2}, sehingga rumus molekulnya yaitu C_6H_{14}

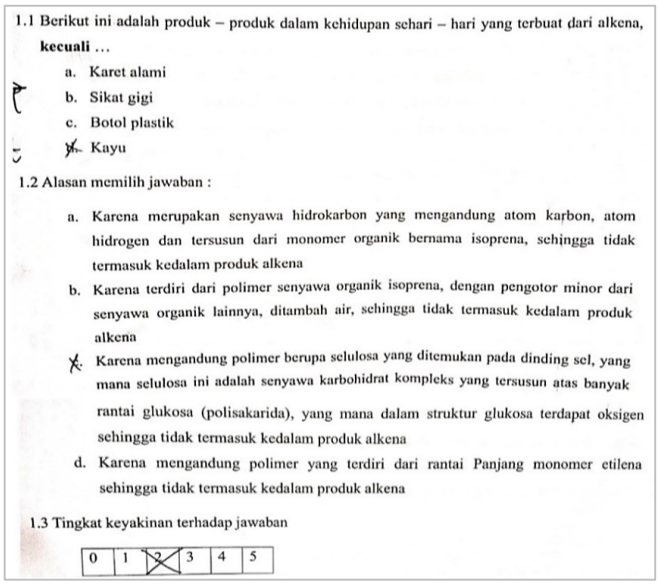
2.3 Tingkat keyakinan terhadap jawaban

0 1 2 3 4 5

Figure 2. Examples of student answers in the category of understanding the concept well on the indicator for writing the molecular formula for alkenes

Understand But Not Sure

The highest category of understanding but not sure is found in the indicator explaining alkenes in everyday life. Based on the results of interviews that have been conducted, students have low confidence in the answers they choose due to being confused between the available options and thus guessing, as well as a lack of overall understanding which causes the students to experience understanding the concept but not being sure. Confidence in a person's knowledge is related to their level of knowledge. Uncertainty arises because students do not have sufficient experience to construct concepts (Perdana, 2017). An example of a student's answer who understands the concept but is not sure about the indicator of being able to write the alkene molecular formula is shown in Figure 3.


1.1 Berikut ini adalah produk – produk dalam kehidupan sehari – hari yang terbuat dari alkena, **kecuali** ...

a. Karet alami
b. Sikat gigi
c. Botol plastik
d. Kayu

1.2 Alasan memilih jawaban :

a. Karena merupakan senyawa hidrokarbon yang mengandung atom karbon, atom hidrogen dan tersusun dari monomer organik bernama isoprena, sehingga tidak termasuk kedalam produk alkena
b. Karena terdiri dari polimer senyawa organik isoprena, dengan pengotor minor dari senyawa organik lainnya, ditambah air, sehingga tidak termasuk kedalam produk alkena
c. Karena mengandung polimer berupa selulosa yang ditemukan pada dinding sel, yang mana selulosa ini adalah senyawa karbohidrat kompleks yang tersusun atas banyak rantai glukosa (polisakarida), yang mana dalam struktur glukosa terdapat oksigen sehingga tidak termasuk kedalam produk alkena
d. Karena mengandung polimer yang terdiri dari rantai Panjang monomer etilena sehingga tidak termasuk kedalam produk alkena

1.3 Tingkat keyakinan terhadap jawaban

0 1 2 3 4 5

Figure 3. Examples of student answers in the understand but not sure category on indicators explaining alkenes in everyday life

Misconceptions

Based on Table 3, the biggest misconception is found in the indicators of being able to explain alkenes in everyday life and being able to describe the structure of alkenes. In the indicator of being able to explain alkenes in everyday life, the student answered the question correctly but incorrectly in the reasons section, and the level of belief he chose was in the igh level belief category. Based on the results of interviews and analysis of the reasons students chose, many of them think that cellulose polymers are alkenes. This assumption makes them not choose the correct answer so that students experience misconceptions. The correct answer is that cellulose is a complex carbohydrate compound composed of glucose chains, whereas glucose does not contain an alkene functional group, which indicates that the compound is an alkene product. The functional

group of alkenes is -C=C- so the answer is not a product of alkenes. Many students experience misconceptions about the use of alkene compounds amounting to 37.50%.

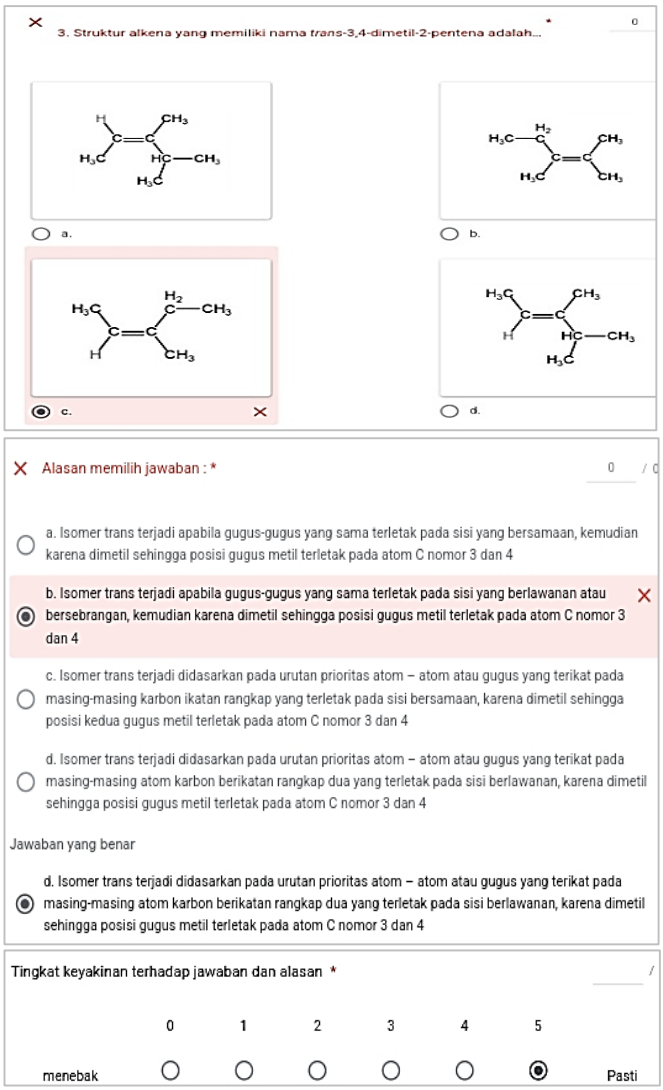


Figure 4. Example of student answers in the misconceptions category on the indicator describing the structure of alkenes for question number 3

Students also experienced the highest misconceptions regarding indicators describing the structure of alkenes. This indicator consists of 2 questions, namely questions number 3 and 4. In question number 3 students are asked to describe the alkene structure of trans-3,4-dimethyl-2-pentene, but as many as 50% of students experience misconceptions. Misconceptions occur because students only know that trans compounds are located opposite each other, and by opposite they do not mean by determining or identifying priority groups first, whereas the correct concept is that trans isomers occur based on the priority order of the atoms or groups bonded to each other each carbon atom has double bonds located on opposite sides. 14% of students experienced difficulty in determining cis and trans isomerism in alkene compounds that have complex structures. Examples of student answers that have misconceptions about indicators describing the structure of alkenes are shown in Figure 4.

In question number 4, students were asked to describe the alkene structure of (Z)-1-bromo-2-chloro-3,3-dimethylbutene, and obtained a misconception percentage of 30%. Students experience misconceptions because many of them think that naming the Z isomer is based only on the location of the group on one side, and many of them are confused about distinguishing between the E and Z isomers, whereas the actual concept, namely naming the E and Z isomers, is determined in The order of priority is in accordance with the Chan-Ingold-Prelog nomenclature system that atoms or groups with higher atomic weights will receive higher priority, as well as giving names to the Z isomerism of high priority groups or atoms located on one side.

Misconceptions can occur due to several factors, one of which is that it comes from students, such as preconceptions that originate from students themselves, students' incomplete or wrong reasoning regarding a concept, wrong intuition, and students' low interest in learning (Nainggolan et al., 2023). Misconceptions also occur due to a lack of mastery of concepts by educators, the language used in textbooks is difficult to understand, and the learning methods applied to the material (Mentari et al., 2014). Students experiencing misconceptions in this research are generally caused by incomplete or incorrect preconceptions and students' reasoning regarding a concept which can be seen based on the reasons they chose and the results of the interviews conducted.

Don't Understand the Concept

Based on Table 3, the highest category of not understanding the concept lies in the indicator being able to explain the reaction of making alkenes. Based on the results of interviews, it was found that students found the material difficult because they did not understand the reaction mechanisms and products produced. This is in line with research Belachew (2020) that students also experience difficulties in understanding reactions in alkenes and understanding reactions in hydrocarbon compounds because reactions in hydrocarbon compounds have more than 2 stages of mechanism and produce more than 1 type of product. The questions on this indicator ask about the products produced from the dehydrohalogenation reaction. Alkenes can be made via a dehydrohalogenation reaction if the alkyl halide is reacted with a strong base. This reaction is characterized by the release of hydrogen

and halogen from the molecule. Examples of answers from students who do not understand the concept of indicators that are able to explain the reaction of making alkenes are shown in Figure 5.

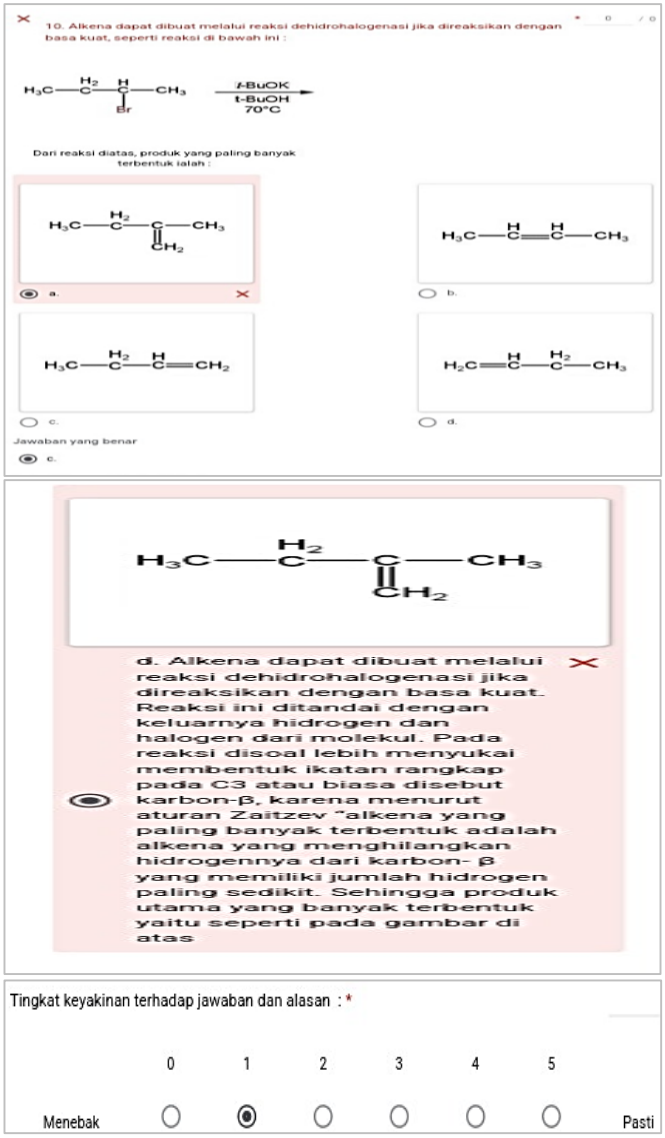


Figure 5. Examples of student answers in the category of not understanding the concept of the indicator explaining the reaction for making alkenes

The existence of steric hindrance in the structure of the alkyl halide compound in this problem causes the main product that is formed more frequently in the dehydrohalogenation reaction in this problem to be an alkene with a double bond at the terminal. Tert-butoxide, as a nucleophile, is a very large molecule so it prefers to attack the hydrogen on the primary carbon atom because it is easier to reach than the hydrogen on the secondary carbon atom. The base used in this reaction is a base that has a large steric hindrance. The alkene product produced is a Hofmann product, namely a less stable and less substituted alkene, namely 1-butene. If the base used does not have steric hidrance then the resulting product follows Zaitsev's rule, namely 2-butene. Many students do not understand the concept because they are fooled by the position of Br which is replaced by CH2 so they think that is where the double bond is located, this indicates that students do not understand the concept.

These results prove that students' understanding is still lacking in the reaction of making alkenes. This could happen because there is a lack of learning time in delivering material on alkene production reactions, and based on the results of interviews, students do not repeat the material again outside of learning hours so that many of them do not understand the concept. Other research also shows that a lack of interest in learning and practicing questions is the cause of students not understanding the learning material (Athiyyaturrahmah et al., 2023; A. K. P. Nasution et al., 2021; Paul et al., 2019).

Based on Figure 6, it can be seen that the class with the highest percentage in the category of not understanding the concept is in the Class of 2021 and the lowest is in the Class of 2022. The highest understanding of the concept well is in the Class of 2019 and the class with the lowest percentage is in the Class of 2021. The lecture system in the Class 2019 and the Class of 2022 were conducted face-to-face, while in the Class of 2021 lectures were conducted face-to-face, so it can be concluded that students who lecture face-to-face have a good understanding compared to students who lecture face-to-face. Other research also states that students prefer face-to-face learning compared to virtual face-to-face learning (Atwa et al., 2022; Bali et al., 2018; Gherheş et al., 2021; Lewohl, 2023). Based on the results of interviews, students also said that face-to-face lectures were easier to understand the material compared to virtual face-to-face lectures.

Understanding of Students in each Generation

This is in line with the research conducted Argaheni (2020), Lodge et al. (2018), Coman et al. (2020), that virtual face-to-face learning makes students confused about the material, and students become less active during lectures. During the face-to-face learning process, students do not experience problems in receiving the information conveyed by the lecturer (Lange et al., 2020; Maatuk et al., 2022). In contrast to virtual lectures, students often have problems with the network so they do not receive information well (Amir et al., 2020; Ong et al., 2023). This is in line with research Dzalila et al. (2020), Saha et al. (2022), Rahayu et al. (2022), and Nasution et al. (2021) which states that problems or unstable networks cause stidents to have difficulty receiving material provided by lecturers virtually.

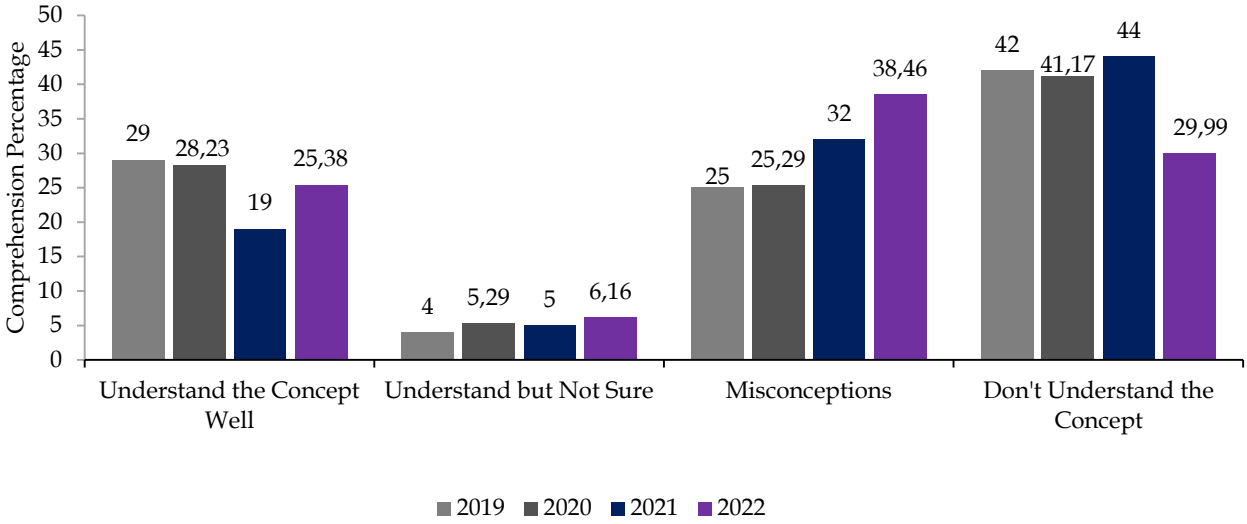


Figure 6. Percentage of student understanding for each generation

In the Class of 2019, the category of not understanding the concept is also included in the high category, because the alkene sub material was studied in the 2nd semester, while the Class of 2019 students are now in the 8th semester. Based on the interview results, this is because the effect of retention of the material has been reduced considerably, and most of them have no contact with it. agains with this material. In face-to-face learning, the Class of 2022 experienced the highest misconceptions. Based on the results of the interviews, students experienced misconceptions because they thought, the concept they knew were the correct concepts. This could happen because the students only had a half-hearted understanding of the concepts so that different concepts emerged from those of the experts.

Conclusion

Untan Chemistry Education students' understanding of alkene submaterials is generally still at the stage of not understanding the concept at 40.21%, with misconceptions at 29.95%, so improvements need to be made in the learning methods and tools used. The category of not understanding the concept is highest in the indicator for making alkenes (64%), the reaction for making alkenes is also an important sub-material in organic chemistry, therefore the high level of lack of understanding regarding this sub-material gives a signal that it is necessary to increase the portion of time or vary the learning media. to be able to increase students' understanding of alkene reactions.

Acknowledgments
Thank you to Comdev & Outreaching Untan for providing scholarship assistance to researchers during their studies.

Author Contributions
Conceptualization, S., R. M., I. L.; methodology, S., R. M, I. L.; validation, R. M. and I. L., M., R. R.; formal analysis, S.; investigation, Selina; resources, Selina.; writing—original draft preparation, Selina.; writing—review and editing, R. M., I. L., M., R. R.; supervision, R. M.; Funding Acquisition, R. M.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

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