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## Development of Contextual-Based Chemistry Modules on Hydrocarbon Compound Materials

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**Abstract:** The lack of modules as teaching materials is an obstacle in learning chemistry, especially hydrocarbon compound material. Therefore, this study aims to develop and validate the feasibility of chemistry e-modules on contextual-based hydrocarbon compound materials and to assess how students and teachers respond to the products developed. Research and development (R&D) method is the method used and ADDIE is the development model applied as methodology. Hydrocarbon compounds as the subject of this study. The modules developed are very feasible to be applied in chemistry learning, according to the results of the data analyzed. The average assessment of lecturer validators 87% is very feasible and the teacher's response is 93% very good, the response of students 92% is very good.

**Keywords:** Chemical Module; Hydrocarbon Compounds; Contextual

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### INTRODUCTION

Information and communication technology (ICT) has changed the way people learn, get various information and can interpret information. This sophistication will have a significant impact in educating and educating the nation's life. In addition, the development of ICT encourages the creation of creative innovations, one example is the birth of the concept of *electronic learning (e-learning)*. *E-learning* is defined as a teaching and learning process that uses electronic circuits to deliver learning content, interaction or guidance. In addition to the above

understanding, there are also those who define *e-learning* as a form of distance education carried out through internet media (Sajiatmojo, 2021). *Electronic learning (e-learning)* is a new learning and learning concept combined with rapidly developing information and communication technology. Face-to-face learning students receive full guidance from educators. But when learning remotely, students must be familiarized with independent learning. Increased independence of participants Learners in learning can occur due to stimulus factors from within and from outside (Panggabean et al., 2021). Distance or online learning requires a teacher to master

science and technology so that online or distance learning can run effectively. This learning concept makes it easier for students and teachers to obtain learning resources with easy and light access. In order to teach students, especially in critical *thinking* skills, *creativity*, collaboration and communication in learning, a teaching material media in the form of electronic modules is needed (Pulungan & Sitepu, 2021).

According (Ginting et al., 2022) by using modules, a learning is expected to be able to bring students to the expected competencies. The strategy of organizing subject matter in the module contains *sequencing* which refers to making the sequence of presentation of learning material, and *synthesizing* which refers to efforts to show students the interrelation of facts, concepts, procedures and principles contained in learning material. To design learning materials, there are five categories of capabilities that can be learned by students, namely (1) verbal information, (2) skills, intellectual, (3) cognitive strategies, (4) attitudes and (5) motor skills (Damanik et al., 2024).

The results of initial observations at SMA Negeri Sember found that the availability of printed teaching materials and the number was still limited and teachers only gave assignments or just through power points or printed books. This shows that there has been no innovation in teaching materials developed such as contextual-based modules for students at SMA Negeri Sember in chemistry subjects, there are still problems found in classroom learning activities on hydrocarbon compound materials.

According to (Suyanti & Ramadhani, 2022) hydrocarbon compounds are the simplest carbon compounds and most often found in nature. The definition of hydrocarbonan compounds themselves is a compound composed of carbon atoms (C) and hydrogen (H). The learning process still does not see the interaction of student activity as a whole in the learning process because teachers

are focused on explaining the concept of material with conventional methods to students. In addition, teacher preparation in preparing learning activities is lacking such as the unavailability of student worksheets and less interesting assessments, making the learning activity process still look passive.

Module is a book written with the aim that students can learn independently without or with teacher guidance (Sutiani & Maisyarah, 2021). Learning with modules allows a learner who has high speed in learning will more quickly complete one or more KD compared to other learners. Thus, the module must describe the KD that will be achieved by learners, presented using good language, interesting, and equipped with illustrations. Modules are considered innovative because they can display teaching materials that are complete, interesting, interactive, and carry out good cognitive functions (Dalimunthe & Ginting, 2022).

## LITERATURE REVIEW

### MODUL

Module is a printed teaching material used by students for learning resources. Modules aim to make students able to learn independently, can be learned anytime and anywhere without having to have any supporting tools. Modules also play a role in training students to learn actively and can also support the effectiveness of achieving learning objectives to test the suitability of modules with competencies that are learning targets (Purba & Sembiring, 2023). If the content of the module is appropriate, meaning that it is effective for learning the competencies that are the target of learning, then the module is declared valid (valid) (Sinaga & Sagala, 2021). Validation can be done by asking for help from experts who master the competencies learned. If there is none, it is carried out by a number of teachers who teach in the field or competency. The validator carefully rereads the contents of the module. Validators check, whether learning objectives, material descriptions, forms of activities, tasks, exercises or other existing

activities are believed to be effective to be used as a medium for understanding competencies that are the target of learning. If the validation results state that the module is invalid, the module needs to be corrected so that it becomes valid (Ayriza, 2008).

## CONTEXTUAL LEARNING

*Contextual Teaching and Learning* (CTL) is one of the learning models that can help students understand learning material that is associated with the context of daily life both social, personal, and cultural contexts. This learning model helps learners understand the material well and encourages learners to be creatively active engaging in classroom learning. In learning with an approach contextually there are 7 main components is (1) Constructivism;(2) Investigation; (3) Asking; (4) Learning Society; (5) Modeling; (6) Reflection; and (7) Authentic Evaluation (Afrida & Sinaga, 2019).

## HYDROCARBON COMPOUNDS

Hydrocarbon compounds are the simplest carbon compounds and most often found in nature. The definition of hydrocarbon compounds themselves is a compound composed of elements of carbon atoms (C) and hydrogen (H This compound is formed from the nucleus of a carbon atom that has four valence electrons. These four valence electrons will bond to valence electrons from other atoms or similar to covalent bonds. In everyday life we encounter many hydrocarbon compounds, such as kerosene, gasoline, natural gas, plastics and others. To date, more than 2 million hydrocarbon compounds are known. To make it easier to study the abundance of hydrocarbon compounds, experts classify hydrocarbons based on the arrangement of the carbon atoms in their molecules (Giovany et al., 2022) The presence of hydrocarbons can be identified through simple experiment, namely with a combustion reaction (Suyanti & Ramadhani, 2022).

## METHODS

This type of development research or known as Research and Development (R&D) (Sugiyono, 2015) This research development method uses ADDIE (Analysis, Design, Development, Implementation, Evaluation). Research focuses on design, feasibility assessment, teacher responses and student responses to module development. The subject of this study is the material of hydrocarbon compounds. E-Module is a product of this research which was validated by 3 material validators and 3 media validators from lecturers of Cenderawasih University (Uncen), responses from chemistry teachers of SMA Negeri Samber Biak and responses from students. Instruments in the form of questionnaires were distributed to 3 chemistry teachers and 10 students.

Data were obtained quantitatively as a result of the distribution of the feasibility questionnaire of the contextual based hydrocarbon compound material chemistry module that had been developed, then a descriptive percentage was carried out. If the total percentage has met the eligibility criteria, then the contextual based hydrocarbon compound chemistry e-module is suitable to be used as teaching material in learning. Validation carried out by validators, namely material validation and media validation is also carried out by teachers and students. The criteria for assessing modules are a range of scores of 2, 1 and 0. The data obtained were analyzed using percentage descriptive, with the following equation:

$$P = \frac{n}{N} \times 100\%$$

(Sudjana, 2005)

Description:

P = percentage of scores obtained,

n = number of scores obtained,

N = maximum number of scores in each aspect.

The validation criteria of validators and teacher and learner responses use Table 1 and Table 2 as follows.

**Table 1.** Eligibility criteria for validation results

Interval % skor	Criterion
75 % < skor ≤ 100 %	Very decent
50% < a score of ≤ 75%	Proper
25% < score ≤ 50%	Less viable
0% < score ≤ 25%	Not worth it

(Rohmad et al., 2013)

**Table 2.** Response criteria for teachers and students

Interval % skor	Criterion
81% < a score of ≤ 100%	Excellent
62% < a score of ≤ 81%	Good
43% < score ≤ 62%	Not Good
25% < a score of ≤ 43%	Bad

(Mardianto et al., 2022)

## RESULT AND DISCUSSION

### Test Module Eligibility

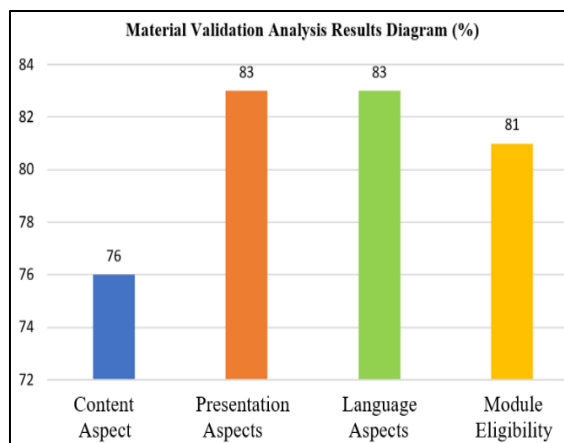
#### Material Validation

The results of the recapitulation of the feasibility analysis of the hydrocarbon compound material module that have been tested by 3 lecturers as validators of both the assessment of material aspects, presentation aspects and language aspects can be seen in Table 3 and refer to Figure 1 as follows:

**Table 3.** Material validation module qualification analysis

Validator	Assessment Aspect Score (%)			Average (%)	Module Eligibility Criteria
	Fill Eligibility	Serving Eligibility	Language Qualification		
V1	82	82	77	80	Very Worth It
V2	80	88	85	84	Very Worth It
V3	65	79	88	77	Very Worth It
Average	76	83	83	81	Very Worth It
Criterion	Very Worth It	Very Worth It	Very Worth It		

Table 3 shows that from the three validators, the results of content feasibility = 76%, feasibility of presentation = 83%, and feasibility of language = 83% so that the average feasibility score of the material validator module is 81%, which means that in terms of material, this module is very feasible to use.



**Figure 1.** Material validator analysis result diagram (%)

Figure 1 is an image from Table 3 where the results of content feasibility = 76%, feasibility of presentation = 83%, and feasibility of language = 83% so that the average module feasibility score is 81% which means the module is suitable for use. The average score of the percentage of module eligibility, especially the validation of material by lecturers when viewed in terms of content eligibility, obtained an average percentage value of 76%, presentation feasibility of 83%, and from the aspect of language feasibility of 83%. From the three aspects above, averaging, 81% results were obtained for the overall assessment of the aspect of the content of chemical module materials on hydrocarbon compound materials. This 81% figure when viewed from the table of criteria for the percentage of eligibility of modules is included in the feasible category. If you look at the percentage range, it is in the range of 65% to 88%. Where the lowest range is in the content feasibility category and the highest range is in the presentation feasibility and language feasibility categories.

This means that in terms of material content, this e-module is qualified for use in research with revisions. If we relate it to previous research conducted by (Sutiani & Lestari, 2022) we can see that the results of module feasibility validation in the feasibility aspect of material content are in the range of 83% to 98% with an average feasibility assessment of module content of 89%. Although the range of values is different, the

final result has an average feasibility value of 89%, which means the same as the results of the researcher's analysis, which is worthy of use with revisions

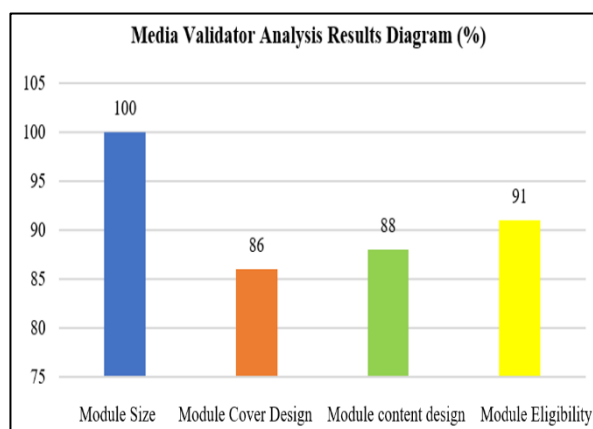
### Media Validation

The results of the recapitulation of the media feasibility analysis on the hydrocarbon compound material module have also been tested by 3 validator lecturers with indicators assessing aspects of module size, aspects of module cover design and aspects of module content design Can be seen in Table 4 and refer to Figure 2 as follows.

**Table 4.** Media validation module feasibility analysis

Validator	Assessment Aspect Score (%)			Average (%)	Module Eligibility Criteria
	Module size	Module cover design	Module content design		
V1	100	92	88	93	Very Worth It
V2	100	85	92	92	Very Worth It
V3	100	74	77	84	Very Worth It
Average	100	86	88	91	Very Worth It
Criterion	Very Worth It	Very Worth It	Very Worth It		

Table 4 shows that from the three validators, the results of the module size aspect (100%), the module cover design aspect (86%) and the module content design aspect (88%) were obtained so that the average module feasibility score was 91%, which means that the module is suitable for use.



**Figure 2.** Media validator analysis result diagram (%)

Figure 2 is an image from Table 4 where the results of content feasibility = 76%,

presentation feasibility = 83%, and language feasibility = 83% so that the average module feasibility score is 81% which means the module is suitable for use. There is a media validation section, the focus of the assessment is on the feasibility aspect which consists of three components, namely, the module size component, the module cover design component, and the module content design component. From the three media expert validations, an average percentage of 100% (e-module size component), an average percentage of 86% (module cover design), and an average percentage of 88% (module content design) were obtained. From the three component indicators of the media feasibility aspect, an average percentage value of 91% was obtained. This means that contextual-based chemistry modules on hydrocarbon compound materials are very feasible to be used as teaching materials.

### Recapitulation of Module Qualification Response by Teacher

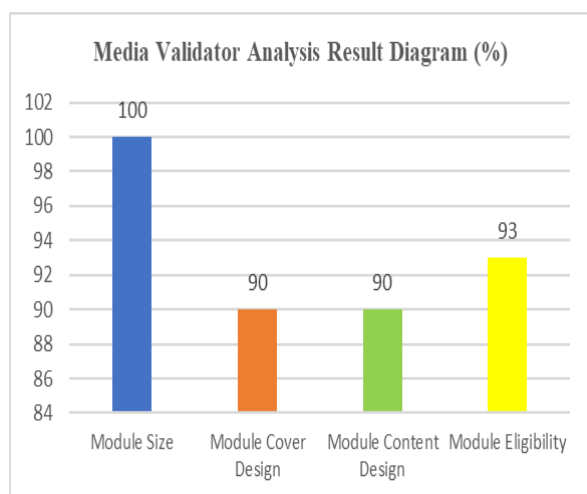
Feasibility testing of e-module hydrocarbon compound material was also carried out by 3 teachers of cognate subjects where the assessment aspects were the same, namely aspects of module size, aspects of module cover design and aspects of module content design can be seen in Table 5 and refer to Figure 3 as follows:

**Table 5.** Media validator module qualification analysis

Validator	Assessment Aspect Score (%)			Average (%)	Module Eligibility Criteria
	Module size	Module cover design	Module content design		
V1	100	95	90	95	Excellent
V2	100	89	91	93	Excellent
V3	100	88	89	92	Excellent
Average	100	90	90	93	Excellent
Criterion	Excellent	Excellent	Sanagt Good		

Table 5 shows that from the three validators, the results of the assessment of the module size aspect (100%), the module cover

design aspect (90%) and the module content design aspect (90%) so that the average module feasibility score is 93%, which means that the module is very good to use.



**Figure 3.** Diagram of the results of media validator analysis by teachers (%)

Figure 3 is an image from Table 4 where the feasibility results of module size = 100%, module cover design = 90%, and module content design = 90% so that the average module feasibility score is 93% which means the module is suitable for use. The teacher's response given by the three subject teachers who teach at SMA Negeri Samber is that the percentage for the module size aspect all obtained a percentage of 100%. As for the module cover design, it obtained a percentage of 90%, and the module content design also obtained a percentage of 90%. Of these three aspects, the average percentage value is 93%, which means it is very feasible to be used in learning. In the opinion of researchers, the average percentage of module eligibility from these three teachers is quite high, this could also be because the module is something new, let alone used directly online, so this is an added value of the teacher's assessment. This is in line with research from (Siregar, 2021) that the chemistry module on the periodic system material of literacy culture-based elements is very good to use (99.04%).

### Recapitulation of Module Readability Analysis by Learners

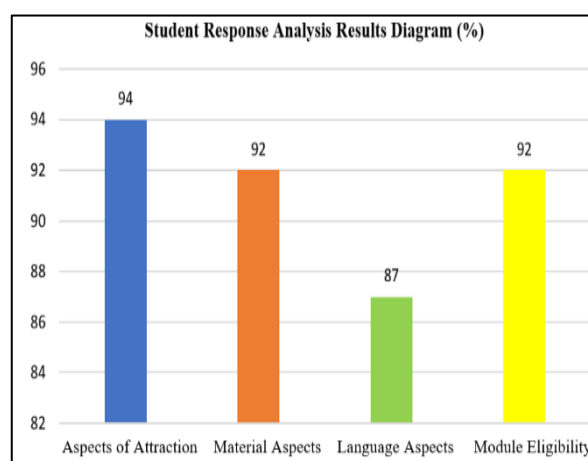
In addition to validating the feasibility of hydrocarbon compound material modules

by lecturers and teachers, researchers also conducted small-scale feasibility tests by 10 students as respondents to determine student responses to the module from aspects of interest, material and language aspects. The results of the analysis of student responses can be seen in Table 6 and refer to Figure 4 as follows.

**Table 6.** Readability analysis of student respondent module

Validator	Assessment Aspect Score (%)			Average (%)	Module Eligibility Criteria
	Aspects of attraction	Material aspect	Language Aspect		
V1	96	96	83	92	Excellent
V2	92	96	92	93	Excellent
V3	96	87	75	86	Proper
V4	92	96	92	93	Excellent
V5	96	96	92	95	Excellent
V6	96	92	92	93	Excellent
V7	87	92	92	90	Excellent
V8	96	92	83	90	Excellent
V9	96	92	92	93	Excellent
V10	96	87	83	87	Good
Average Criterion	94 Excellent	92 Excellent	87 Good	92	Excellent

Table 6 shows that out of ten respondents obtained aspects of interest (94%), material aspects (92%), aspects of Language (87%), so that the average module feasibility score of 92% thus according to students this module is very good for use in learning.



**Figure 4.** Diagram of analysis results 6 readability of modules from students (%)

Figure 4 is an image from Table 6 where the results of student responses were obtained from aspects of Interest (94%), material aspects (92%) and language aspects (87%) so that the average module feasibility



score was 92%. The response of students at SMA Negeri Samber, especially class XI Science. Students provide assessment by filling out questionnaires of students' responses to Contextual based Chemistry e-modules on hydrocarbon compound materials. The average percentage result was obtained that the aspect of interest obtained the highest percentage of 94%, this shows that students are interested in reading and using the contextual-based chemistry module that has been given. For the material aspect, an average percentage result of 92% is obtained, which means that students understand the material well and have an interest in studying chemicals, namely hydrocarbon compounds. As for the language aspect, it obtained a percentage of 87%, which means that aspects of language use and sentences in the e-module can be understood by students according to their level of education, the letters used are also easy to read so as not to cause misinterpretation.

Previous research conducted by (Siregar & Patimah, 2021) found that the guided inquiry-based Integrated Science module obtained a very good category (92.68%) used as teaching material. The contextual-based chemistry module developed by researchers also obtained a very feasible category based on the results of the feasibility percentage obtained from material validators and media validators with an average percentage of 90%.

Furthermore, by (Pujowati et al., 2020) with the title "Development of an Integrated Science Module Based on Science Literacy on Substance Pressure Material". The study found that there was an increase in student learning outcomes by learning using integrated science modules on science literacy-based substance pressure materials, the results of student responses or responses by 77.76% were very good categories used as teaching materials using modules.

## Comparison of Module Validation Test Results

The results of the material and media validator recaps by both lecturers and teachers and student responses can be seen in Figure 5 of the following diagram:

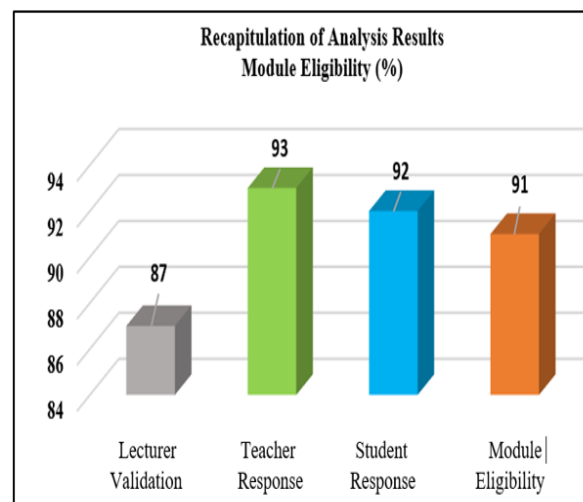


Figure 5. Recapitulation diagram of module feasibility validation test analysis

Figure 5 shows that the average validation by lecturers is 87%, this figure is obtained from the results of material and media validation tests averaged. For teacher responses to modules, a percentage of 93% was obtained, while for student responses a percentage of 92% was obtained.

The percentage of teacher and student responses is in the very feasible category in contrast to the percentage of lecturer validation which is in the feasible category. This can be because the use of e-modules at SMA Negeri Samber itself is something that has never been done in the learning process so that it provides added value for both teachers and students. However, overall the validation results both by lecturers, teacher responses and student responses showed an average score of 91%, which means that overall the e-module is very feasible to be used in this study. The same thing was done by (Siregar, 2023) "Development of the reaction rate material chemistry module through a scientific approach" that the reaction rate material chemistry module is very feasible to be used (91.77%) as teaching material. The results of the module assessment by material

experts, media experts, chemistry teachers and students with very feasible categories, it can be concluded that the contextual-based hydrocarbon compound material chemistry module is very feasible to be used in chemistry learning in class XI of SMA Negeri Sember Biak.

## CONCLUSION

Based on the research results, a chemical e-module on contextually based hydrocarbon compound material was successfully developed by researchers by obtaining feasibility scores from several expert validators. Meanwhile, the average score from lecturer validators was 87% with very decent criteria and teacher responses were 93% with very good criteria, and student responses were 92% with very decent criteria.

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