IJCE, Vol. 1, No. 2, December 2024, pp. 63 – 69

Indonesian Journal of Chemical Education

https://journal.uny.ac.id/index.php/ijce/index

Analysis of Teacher Needs for A Contextual Chemistry Module Based on Multiple Representation Integrated Islamic Values in Hydrocarbon Materials

Salma Salsabila ✉[1)], Nurfina Aznam[2)]

[1,2)] Department of Chemistry Education, Universitas Negeri Yogyakarta, Indonesia

Article Info

Received: Dec 23th, 2024
Revised: Dec 29th, 2024
Accepted: Dec 31th, 2024

Keywords:
requirements analysis, module, integration of Islamic values, multiple representation

Abstract

This research aims to analyze the need for the development of a contextual chemistry module based on multiple representations integrated with Islamic values in hydrocarbon materials. This research method is qualitative descriptive research with data collection techniques in the form of structured interviews using interview guidelines for chemistry teachers at Madrasah 'Aliyah. The data analysis technique used is Miles-Huberman Interactive Analysis with stages of data collection, data display, data reduction, and drawing conclusions. The research findings reveal: 1) The curriculum implemented in schools is the independent curriculum. 2) Most students show a lack of interest in chemistry, particularly in hydrocarbon topics. 3) Students' religious character has declined. 4) The integration of Islamic values in learning is suboptimal and teachers possess limited knowledge of scientific developments. 5) No learning resources based on multiple representations and integrated with Islamic values are available. Based on the needs analysis conducted, a chemistry module with a contextual approach based on multiple representations integrated with Islamic values in hydrocarbon materials can be developed.

✉ Corresponding Author:
Salma Salsabila
irfansyahnabilazuardi.2020@student.uny.ac.id

e-ISSN 2581-2645

INTRODUCTION

Discussing the relationship between the Qur'an and science should focus on Qur'anic verses that encourage and motivate the advancement of science and technology. Beyond that, the Qur'an continuously invites humans to use their intellect by reflecting on the signs and evidence present in everyday life. It is important to understand that no verse in the Qur'an contradicts existing scientific findings (Azhar, 2016). Classroom learning can be integrated with religious values by combining learning materials with aspects of religious values relevant to the context and discussion (Ana, 2019). Additionally, the implementation of contextual learning that focuses on real-world situations is essential in the learning process. Contextual learning aims to make the learning process more meaningful for students, engaging them in scientific activities rather than passively receiving knowledge from teachers (Suprijono, 2011).

Ideally, chemistry teachers would implement the chemical triangle of multiple representations, consisting of macroscopic, submicroscopic, and symbolic levels. The macroscopic level explains phenomena observable by the senses. The submicroscopic level describes aspects that cannot be observed directly, while the symbolic level uses specific symbols to represent phenomena (Johnstone, 2000). Students interested in chemistry will find it easier to understand the material taught by teachers. Teachers strive to convey concepts in ways that all students can comprehend, connecting the material to real-life experiences to help students visualize chemical processes more easily. This forms the foundation for using multiple representations and the tetrahedral chemical concept in chemistry education (Mahaffy, 2006).

Chemistry is one of the natural sciences subjects that is relatively challenging to understand. One topic students often find difficult is hydrocarbons. Students struggle with cognitive aspects such as determining hydrocarbon nomenclature according to IUPAC rules, distinguishing and identifying alkane, alkene, and alkyne isomers, recognizing chemical properties of hydrocarbon compounds, and explaining reactions and processes at the particle level, such as identifying C, H, and O elements (Eky et al., 2018). Current chemistry instruction often emphasizes macroscopic and symbolic levels, neglecting the submicroscopic level. This results in incomplete and shallow understanding of chemistry, posing challenges in grasping abstract concepts. An optimal chemistry learning process addressing these issues can be achieved through teaching materials such as modules. Modules are a type of teaching material structured systematically using language appropriate to students' knowledge and age levels, enabling them to learn independently with minimal teacher assistance (Prastowo, 2011).

Various studies have focused on developing chemistry modules with differing materials and content approaches. For example, research conducted by Maulida (2022) in a thesis entitled Pengembangan Modul Kimia Berbasis Nilai-Nilai Islam pada Materi Struktur Atom di MAS Darul Ihsan Aceh Besar, research by Adawiyah, Andayani, and Savalas (2022) in a journal entitled Pengembangan Modul Kimia Etnosains Terintegrasi Model Culturally Responsive Transformative Teaching (CRTT), and research by Zulfahrin (2019) in a thesis entitled Pengembangan E-Modul Kimia Berbasis Problem Based Learning (PBL) untuk Meningkatkan Pemahaman Konsep Siswa. Despite numerous studies on chemistry learning modules, the development of a hydrocarbon module based on multiple representations integrated with Islamic values remains necessary. This is crucial as it links chemistry concepts with moral and ethical values in education, particularly in Islamic-based schools. Integrating Islamic values into chemistry learning enriches students' understanding of hydrocarbon material and fosters their character and attitudes in addressing scientific and social challenges. Using the multiple representation approach, this module is expected to provide a more comprehensive and profound learning experience. Students will not only understand the scientific aspects of hydrocarbons but also apply the taught values in their daily lives. Thus, this study aims to develop a module that meets academic standards while also being culturally and spiritually relevant to students. A contextual chemistry module based on multiple representations integrated with Islamic values on hydrocarbon material is an appropriate learning resource for this purpose. The module is designed to guide students in understanding the material, developing higher order thinking skills, studying real-life phenomena, and internalizing Islamic values related to the topic.

METHODS

Type and Design of the Research

This research uses a type of qualitative research that focuses on the development of a product. Qualitative research is a type of research that involves collecting data through interviews, observation, and document analysis. In this process, the researcher plays an active role in interpreting the data in a narrative manner to be able to produce conclusions. The focus of qualitative research is subjective understanding rather than producing broad generalizations (Rijali, 2018). This study also applied an exploratory survey method to chemistry teachers to gain insight into the needs, challenges, and expectations of teachers regarding the chemistry learning module to be developed. Exploratory surveys allow researchers to identify various relevant perspectives from teachers to design products that are more suitable for the context of learning in the classroom and increase the effectiveness of chemistry teaching, especially hydrocarbon materials. Therefore, the results of this survey are expected to make a significant contribution to the development of a contextual chemistry module based on multiple representations integrated with Islamic values on hydrocarbon materials.

Participants and Context of the Research

The subjects in this study were chemistry teachers of Madrasah 'Aliyah in Yogyakarta and Central Java with the following criteria, i.e. (1) have experience teaching hydrocarbon materials, (2) experienced changes in curriculum implementation during teaching, (3) using print media as a learning resource, (4) has a minimum teaching experience of 3 years starting from 2021.

Data Collection Technique and Instrument

The data collection instrument used interview guidelines adapted from the interview guideline grids in Winarni's (2018) research. Interview as a data collection technique that involves direct interaction between the

researcher and the subject or respondent. The implementation of interviews occurs question and answer conducted in a structured manner and based on research objectives. The interview technique was carried out to obtain in-depth and comprehensive initial information about the needs in the preparation of contextual chemistry modules with Madrasah 'Aliyah chemistry teachers. Interviews with chemistry teachers were conducted with structured interviews in accordance with interview guideline questions that had been adjusted to the needs and objectives of the study.

The data analysis technique used is Interactive Analysis from Miles & Huberman (2007) which consists of three stages simultaneously starting from data presentation, data reduction and conclusion drawing or verification. The stages of data analysis of the research conducted can be seen in Figure 1.

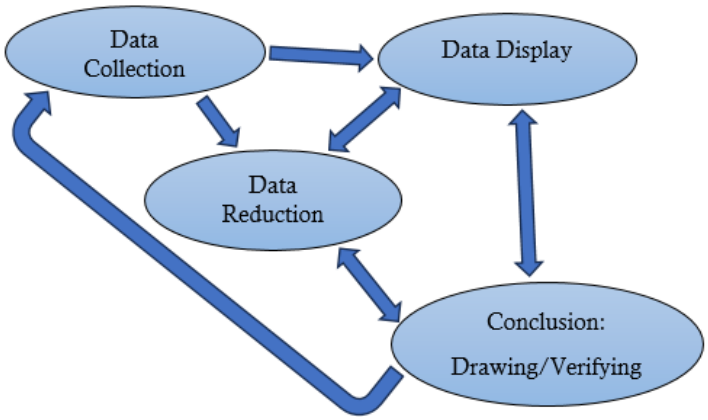

Figure 1. Data Analysis Stages

Data Analysis

In this study, data analysis was conducted through a series of systematic stages to ensure the validity and reliability of the findings. The analysis process began with recording all findings of phenomena obtained from interviews with Madrasah 'Aliyah chemistry teachers. The collected data were then reduced through an analysis that included grouping, sorting, deleting irrelevant data, and organizing the data systematically. Furthermore, the description of the clarified data was carried out by considering the focus and purpose of the research, thus providing a clear picture of the context under study. Finally, a comprehensive analysis was conducted to obtain in-depth research results.

FINDINGS AND DISCUSSION

Findings

Needs analysis is the first step in identifying problems that arise during the learning process. This process is carried out to collect information related to the potential, problems, and obstacles faced in learning chemistry, so that it can be used as a reference for consideration in the module preparation process. Through module needs analysis of teachers, researchers can find out the urgency of developing contextual chemistry modules based on multiple representations integrated with Islamic values on hydrocarbon material.

This study conducted an initial analysis with interview techniques to 7 chemistry teachers in schools, especially Islamic-based schools or known as Madrasah 'Aliyah in Yogyakarta and Central Java. The interviews were conducted in a structured manner using interview guidelines. The results of the analysis through interview techniques produce some important information that can be seen in Table 1.

Table 1. Interview Results

	Interview Results
1.	Implementation of the independent curriculum has been done in every school.
2.	Chemistry learning carried out in schools is quite diverse by applying models and methods that are in accordance with environmental conditions, material characteristics, and students.
3.	Students are easily bored with theoretical chemistry material, one of which is hydrocarbon material.
4.	Students have difficulty in learning hydrocarbon material, especially in the reaction and isomer sections.

Interview Results
5. The religious character of students has decreased as a result of the pandemic and the influence of social development of the times.
6. Efforts to implement character strengthening are still limited due to the lack of integration of Islamic values during learning.
7. Teachers do not know the term thinking in multiple representations as a form of scientific development.
8. Learning resources available at school consist of textbooks and worksheets which are said to be insufficient to meet learning needs in the classroom.
9. The urgency and benefits of the module as one of the independent learning resources for students.
10. Independent learning resources such as contextual chemistry modules based on multiple representations integrated with Islamic values on hydrocarbon material to support students' understanding are not yet available at school.

Discussion

Based on the results of the interviews presented in table 1. about the analysis of teacher needs for contextual chemistry modules based on multiple representations integrated with Islamic values on hydrocarbon material, it can be seen that,

Curriculum analysis was conducted to find out the applicable curriculum in the research school. This is done because researchers need to adjust the objectives and learning outcomes that will be included in the learning module. All research schools have implemented the independent curriculum, especially in grade 10 and grade 11, although there are still schools that implement the 2013 curriculum in grade 12. The change in the curriculum that applies in schools, namely the 2013 curriculum to the independent curriculum, causes changes and differences in the implementation process. The difference lies in the scope of the material and the learning process carried out in the classroom.

Changes in material coverage in chemistry subjects for phase E where there are additional new materials such as green chemistry and nanotechnology, and global warming. In addition, changes in material coverage lie in the sequence of learning that varies in each school, because policies regarding material coverage are released to each school. Schools need to categorize materials for each phase based on their level and characteristics. Meanwhile, in the learning process, the teacher's role is more as a companion and feedback provider, while students are encouraged to search for materials independently through various learning resources available at school. Nevertheless, this does not reduce the importance of the teacher's role in learning because in practice, the teacher remains the main reference in the process of transferring knowledge. Learners may have the freedom to explore materials independently, but teacher guidance and explanation are still needed to ensure that the understanding gained is in accordance with the learning objectives and the established curriculum. Combining independent learning and teacher support, learners can develop critical and independent thinking skills and gain a deeper understanding of the material learned.

Chemistry materials include most of the concepts in it are abstract concepts, causing chemistry to be one of the difficult lessons and less favored by most students. In addition, students complain that the chemistry material learned in class is less relevant to everyday life, causing chemical materials and concepts not to be fully understood by students (Indrayani, 2013). Chemistry is one of the science subjects that is quite challenging to understand. One material that is often considered difficult is hydrocarbons. The material requires a deep and thorough understanding of the concept. Students who study hydrocarbons are required to be able to understand the name of hydrocarbons, types and properties of hydrocarbons, isomers, and uses in everyday life (Agustina et al, 2013).

Learners tend to be bored and less interested when learning chemistry is done theoretically and abstractly. Chemistry concepts that are complex and far from everyday life are often difficult to understand, so interest in learning decreases. However, when chemistry learning is varied to be more interactive through practical experiments and linked to real contexts relevant to everyday life, learners' interest tends to increase. Contextualized learning will not only increase learners' interest but can help them to relate chemical concepts to real problems they face, so that learning becomes more relevant and meaningful. Learning chemistry, especially in hydrocarbon materials, students often face difficulties in learning the reaction and isomer parts. In the reaction section such as combustion, addition, substitution, and elimination reactions, students experience confusion regarding the types of reactions that apply to hydrocarbon compounds. Chemical reactions that occur in hydrocarbon compounds can be learned by understanding the chemical bonding material in hydrocarbon molecules and the interaction of compound structures

under certain reaction conditions. In addition, difficulties also occur in the isomers section which involves the process of identifying compounds and interpreting the structure of different isomers with the same formula.

Chemistry learning in Islamic-based schools continues as in public schools, but there are differences in the implementation of religious values. Islamic-based schools usually integrate more religious values in the teaching and learning process. For example, learning is done by linking chemistry materials with Islamic principles, so that students not only learn chemistry concepts but also strengthen spiritual and moral character. In addition, the integration process is carried out in general as a motivation in terms of strengthening character such as in terms of faith and piety. However, the impact of the covid-19 pandemic and the association of the times is still felt by teachers who show a decrease in the religious character values of students. This can occur because the distance learning process is less effective for instilling moral and religious values compared to face-to-face learning in a formal environment such as school. The cultivation of religious character is a big challenge because during the pandemic and the socialization of the times, opportunities to implement religious values both inside and outside the classroom are limited and hampered.

Schools need to strengthen efforts to integrate Islamic values in subjects as an effort to overcome these problems, including chemistry subjects, especially hydrocarbon materials. This can be done by developing learning modules that not only teach science concepts, but also instill character values. In addition, there is a development of integrative strategies in teaching and learning in the classroom, so that chemistry can be taught with a relevant religious perspective. It is hoped that the learning process can take place with the cultivation of religious character through more effective chemistry learning. However, the effect of instilling religious character has not been maximized, which is characterized by a decrease in religious character in students. Efforts to implement character strengthening are still lacking due to limited resources and the process of integrating Islamic values in the learning process.

There are other challenges in the chemistry learning process, namely the limited understanding of teachers about the development of science. One evidence of the development of science is the concept of thinking in multiple representations. Multiple representations refer to the ability to understand material through various forms of representation such as visual, verbal, and symbols which in multiple representations are called macroscopic, submicroscopic, and symbolic levels. The concept of thinking can help students understand abstract chemical material more deeply and holistically. However, many teachers do not utilize or even know about this thinking strategy. Thinking in multiple representations can be an effective tool in teaching chemistry, especially in terms of contextualizing chemistry so that it is relevant to life and connecting chemistry concepts with religious values, thus enabling students to see the relationship between science and religion in various perspectives. Improving teachers' understanding and skills in using multiple representations will not only facilitate the integration of Islamic values but also strengthen religious character and facilitate students' understanding with more meaningful and comprehensive learning.

Islamic-based schools only use learning resources in the form of books in learning chemistry. These learning resources are considered insufficient to meet the learning needs in the classroom, especially in learning chemistry. This limitation adds to the challenges faced by teachers in the process of integrating Islamic values and scientific concepts of hydrocarbon material by thinking in multiple representations. The unavailability of more varied and relevant learning resources such as contextual chemistry modules based on multiple representations that incorporate religious values for hydrocarbon materials, efforts in strengthening the religious character of students are difficult to achieve optimally. The development of more comprehensive teaching materials, both in terms of content and delivery methods is needed so that the chemistry learning process can take place optimally, in accordance with the religious context and real life, and apply the development of modern science.

Module development as one of the independent learning resources for students is a necessary need in the learning process, including learning chemistry hydrocarbon material. Learning module can be defined as the smallest program unit that can be studied independently, individually or directly by students themselves (Winkel, 2009). Learning modules provide opportunities for students to explore material independently and structured without full dependence on the teacher in the classroom. The urgency of developing contextual chemistry modules is very important in supporting the success of the learning process, especially in terms of chemical education in Islamic-based schools. It is very useful especially in boarding school-based Islamic schools where there is a prohibition for students to bring gadgets that can be used as learning media. According to the Directorate of Vocational High School Development (2008), modules have five characteristics, namely:

1. Self Instruction, learners can learn independently and do not depend on other parties.
2. Self Contained, all learning materials needed are listed in the module.
3. Stand Alone, the module does not depend on other teaching materials or does not have to be used simultaneously with other teaching materials.
4. Adaptive, modules can adjust the development of science and technology and are flexible for use in various hardware.
5. User Friendly, modules have instructions and information that are simple, easy to understand, and use commonly used terms.

The module that will be developed by thinking in multiple representations and integrated with Islamic values can provide a more comprehensive understanding of chemical concepts, especially hydrocarbons. The concept of thinking utilizes various ways to represent information with four levels: macroscopic, submicroscopic, symbolic, and human element as part of the context of hydrocarbon chemistry material that will be integrated with Islamic values. The hope is that students can learn chemistry, especially hydrocarbon materials with various forms of representation, so that they can more easily understand abstract and complex concepts. In addition, the module will be integrated with Islamic values that will build and strengthen the religious character of students.

CONCLUSION

Based on the needs analysis conducted, it can be concluded that there is a need for the development of a chemistry module with a contextual approach based on multiple representations integrated with Islamic values in chemistry material, namely hydrocarbons. Therefore, a contextual chemistry module based on multiple representations integrated with Islamic values on hydrocarbon material was developed with the aim of making it easier to learn hydrocarbon material by implementing multiple thinking strategies and as a religious character booster for students.

REFERENCES

Adawiya, R., Andayani, Y., & Savalas, L. R. T. (2022). Pengembangan modul kimia etnosains terintegrasi model culturally responsive transformative teaching (CRTT). *Journal of Classroom Action Research*, 4(4), 123-128. https://doi.org/10.29303/jcar.v4i4.2395

Agustina, E., Saputro, A. N., & Mulyani, S. (2013). Penggunaan metode pembelajaran jigsaw berbantuan handout untuk meningkatkan aktivitas dan prestasi belajar siswa pada materi pokok hidrokarbon kelas xc sma negeri 1 gubug tahun ajaran 2012/2013. *Jurnal Pendidikan Kimia Universitas Sebelas Maret*, 2 no. 4, 66-71.

Akbar, S. (2013). *Instrumen perangkat pembelajaran*. Bandung: PT. Remaja Rosdakarya.

Amelia, O., Sundari, P. D., & Sundari, W. S. (2024). Analisis kebutuhan pengembangan e-modul dengan pendekatan contextual teaching and learning untuk meningkatkan pemahaman konsep pada materi energi terbarukan. *Jurnal Ilmiah Profesi Pendidikan*, 9(1), 34-39. https://doi.org/ 10.29303/jipp.v9i1.1849

Ana, F., Abdul, W., & Wirda, U. (2019). Pengembangan bahan ajar kimia berbasis integrasi Islam-sains materi minyak bumi sebagai implementasi pendidikan karakter. *Jurnal Educational Chemistry*, 15-22. https://doi.org/10.21580/jec.2019.1.1.3937

Azhar. (2016). Manusia dan sains dalam persepektif Al-Qur'an. *Lantanida Journal*, 72-86.

Johnstone, A. H. (2000). Pengajaran kimia - logis atau psikologis? Kimia Pendidikan: Penelitian dan Praktek di Eropa, 1(1), 9-15.

Maulida, S. (2022). Pengembangan modul kimia berbasis nilai-nilai islam pada materi struktur atom di MAS Darul Ihsan Aceh Besar. *Skripsi*. Banda Aceh: UIN Ar-Raniry.

Melita, Hartati, Y. S., & Dwintia, S. (2022). Analisis kebutuhan pengembangan modul pembelajaran merancang proposal karya ilmiah berbasis project based learning. *Metamorfosis. Jurnal Bahasa, Sastra Indonesia, dan Pengajarannya*, 15((2)), 38-47. https://doi.org/10.55222/metamorfosis.v15i2.865

Miles, M., & Huberman , A. (2007). *Analisis data kualitatif. (T. R. Rihidi, Penerj.)* Jakarta: UI Press.

Mahaffy, P. (2006). Moving chemistry education into 3D : A tetrahedral metaphor for understanding chemstry. Union Carbride Award for Chemical Education 1, 83((1)), 49-55. https://doi.org/ 10.1021/ed083p49

Prastowo, A. (2011). *Panduan kreatif membuat bahan ajar*. Yogyakarta: Diva Press.

Radjak, D. S. (2024). Analisis kebutuhan pengembangan e-modul relasi dan fungsi berbasis contextual learning terintegrasi nilai keislaman. *Jurnal Limit Multidisiplin*, 1(1), 14-23.

Rijali, A. (2018). *Analisis data kualitatif. Banjarmasin*: UIN Antasari Banjarmasin.

Sugiyono. (2010). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif*, R&D. Bandung: Alfabeta.

Suprijono, A. (2011). *Model-model pembelajaran*. Jakarta: Gramedia Pustaka Jaya.

Uz, Z.L. (2029). Pengembangan e-modul kimia berbasis problem-based learning (pbl) untuk meningkatkan pemahaman konsep siswa. *Skripsi*. Semarang: Universitas Negeri Semarang.

Winarni, E. W. (2018). *Teori dan praktik penelitian kuantitatif kualitatif*. Jakarta: Bumi Aksara.

Winkel, W. (2009). *Psikologi pendidikan dan evaluasi belajar*. Jakarta: Gramedia.