



Analysis of Socio-Scientific Issues in Chemistry Textbooks for Form IV and V in Malaysia

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Article Info	Abstract
Received: Jul 15 th , 2024 Revised: Oct 10 th , 2024 Accepted: Oct 27 st , 2024	Malaysia as one of the countries that has integrated STEM in its education curriculum has a close relationship with SSI-based learning. Students' understanding of SSI is influenced by all important components in supporting the implementation of the learning process, one of which is the textbook. This study aims to compare the number of occurrences of SSI topics based on the level and stage of presentation between level IV and V chemistry textbooks in Malaysia. This qualitative research uses documentary method with descriptive content analysis design. A total of 2 level IV and V textbooks were selected using purposive sampling as data sources. The instrument used was a tabular coding analysis sheet consisting of two focuses of study, namely the level and stage of presentation. The coding results were then analyzed using the delphi technique with 2 expert lecturers. The findings in this study revealed that the number of SSI occurrences in chemistry textbooks level IV and V in Malaysia in terms of topics was 71 data. The book that has a higher occurrence of SSI topics is level IV chemistry textbooks. The number of SSI occurrences in terms of the most presentation stages as material is 37 data, the presentation level in the form of N/A is 41 data, from the global SSI aspect is 51 data, from the chemical concept is 141 data, from the SSI dimension is 213 data, and in terms of other chemical concept mapping is 93 data.
Keywords: textbooks, socio-scientific issues	

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INTRODUCTION

Learning in the 21st century requires educators to be able to equip students with 21st century skills or 4C (Critical Thinking, Collaboration, Creativity, and Communication) (Siong et al., 2018). Chemistry is one of the fields of science that is growing rapidly until now. Chemistry learning in the 21st century is expected to no longer emphasize conceptual understanding, but also directly involve students to deal with situations, challenges, and impacts that occur in everyday life. Through understanding the concept of science, students are expected to be able to use and connect between the understanding of chemistry concepts obtained in understanding, facing, and resolving science issues from various dimensions that occur in society (Dewi et al., 2022).

Learners' perspectives on how to learn, communicate, and interact with the environment around them have developed as a result of the guidance of a competition. Learning in the 21st century emphasizes the application of the STEM (Science, Technology, Engineering, and Mathematics) approach (Muttaqin, 2023). Many programs have made STEM the main area of concentration to improve global competitiveness. As part of the field of education, STEM learning integration must be implemented because STEM learning has the potential to train learners in solving problem issues in real-world situations (Aydin et al., 2018).

Malaysia is one of the countries that has used the STEM approach in its education curriculum starting from the Secondary School Standard Curriculum (KSSM). This effort was made by the Malaysian Ministry of Education to improve the results of the Program for International Student Assessment (PISA) (KPM, 2015). This is because

Malaysia experienced a decrease in the last PISA results in 2022 from 2018, by 6.29% and especially in science literacy results showing it is still below the OECD average with a score of 415 (OECD, 2023).

Science literacy as one of the assessments in PISA is not only related to aspects of mastery of science, but also intersects with social aspects (Rahmawati et al., 2018). Chemistry as one of the science learning is considered unpopular among students (Avargil et al., 2020). Most chemistry materials are considered abstract, making students feel unmotivated from the start to “do science” and learn “science” (Atasoy et al., 2020). This fact has made various efforts so that science, especially chemistry, can be more attractive to students by implementing learning that is more meaningful in life (Yessi, 2021).

SSI or Socio-Scientific Issues is defined as an issue in social life that is conceptually closely related to science so that it causes debate because it does not have an definitive or open answer (Anagun & Ozden, 2010; Sadler, 2004). SSI was chosen as a learning context because it can be used to make science lessons more relevant to students and develop scientific literacy (Pratiwi et al., 2016). Chemistry learning that focuses on SSI has an important role in developing 21st century skills to prepare for the future (Calik & Wiyarsi, 2021).

Students' understanding of SSI is influenced by all important components in supporting the implementation of the learning process, one of which is the textbook. Textbooks are one of the learning resources that are often used in school learning (Miranti, 2023). SSI-based chemistry textbooks can be used in teaching and learning activities because they can inform scientific literacy in teaching participants (Nurhayati et al., 2016). In the context of using chemistry textbooks as the main learning resource, it is important to analyze further so that it can be seen to what extent chemistry textbooks in Malaysia have integrated SSI content.

METHOD

Type and Design of The Research

This research is a qualitative research using documentary method with descriptive content analysis design. This research design is used because data collection is done by understanding and analyzing text or verbal data.

Participants and Context of the Reserach

The samples of this study were two chemistry textbooks for high school level IV and V used in Malaysia. The selection of the textbooks analyzed was determined by purposive sampling technique with the criteria that the textbooks use the secondary school standard curriculum (KSSM) recommended by the Malaysian Ministry of Education. The selection of these two books has also been confirmed from the results of an interview with one of the high school chemistry teachers in Malaysia.

Data Collection Technique and Instrument

Data collection techniques in this study were primary and secondary coding document analysis. Document analysis was conducted to obtain data in the form of SSI content contained in high school chemistry textbooks level IV and V in Malaysia. The first step taken in collecting data, namely the author writes down the reference source of the analyzed book then reads and analyzes in detail and carefully in both chemistry textbooks in order to get valid SSI content information. The author must understand all the text elements in the analyzed book in order to find valid data and in accordance with the research objectives. After finding the data, the author marks the parts that are considered to have the appearance of SSI content which will later be used to interpret the data. The parts that have been marked and considered to have the appearance of SSI content in chemistry textbooks are then entered into a table and matched according to the focus of analysis. The instrument used in this research is a coding analysis sheet adapted from Calik & Wiyarsi's (2021) research entitled systematic review of research papers on socioscientific issues focusing on chemistry. There are 7 SSI theme codes in the table contained in the research paper systematic review coding analysis sheet, namely objectives, variables, samples, SSI, chemical concepts, SSI dimensions, and conclusions. The researcher adapted it by changing it into seven themes that became the focus of study in textbook analysis research. The seven theme codes studied are SSI topics, presentation stages, presentation levels, SSI aspects, chemical concepts, other related chemical concepts, and SSI dimensions and presentation levels to see the extent to which SSI content is integrated in high school chemistry textbooks in Malaysia. The research instruments used have been confirmed and given corrections by expert lecturers in chemistry education.

Data Analysis

Data analysis techniques in this study used interpretative content analysis, delphi techniques with qualitative expert lecturers in chemical education, and descriptive statistics. The data analysis steps taken in content analysis are organizing data, processing data, and coding data into secondary codes by reviewing primary codes interpretatively. The results of the secondary coding that have been obtained are then confirmed by performing the delphi technique to a chemistry education expert lecturer who understands about qualitative research and chemistry textbooks in Malaysia and confirmed to one high school chemistry teacher in Malaysia as an implementer of chemistry learning in Malaysia. so that interater coding will be obtained. Meanwhile, descriptive statistics aim to summarize the data obtained and assist in interpreting the results of the study. In content analysis, data interpretation involves frequency analysis and percentage calculation. The final result of the coding is obtained in the form of numbers.

FINDINGS AND DISCUSSION

Findings

Based on the data obtained from the analysis of SSI topics that appear in high school chemistry textbooks in Malaysia level IV and V, it shows that there are 71 data. The results of the research data were carried out validity and reliability by lecturers as experts to determine the kappa intereter value which showed agreement. Table 1 shows the results of the kappa index value for both books as follows.

Table 1. Expert kappa index recapitulation findings

Form	Indeks Kappa
IV	0,91%
V	

Both books show a very good kappa index value or are included in the almost perfect category because they have a kappa index value > 0.81 . The kappa index value in level IV chemistry textbooks is 0.9% and in level V chemistry textbooks is 0.93%. The results of the study are in the form of data tabulation represented using the percentage value of SSI content in both books. The content includes SSI topics, presentation stages, presentation levels, SSI aspects, chemical concepts, other related chemical concepts, and SSI dimensions.

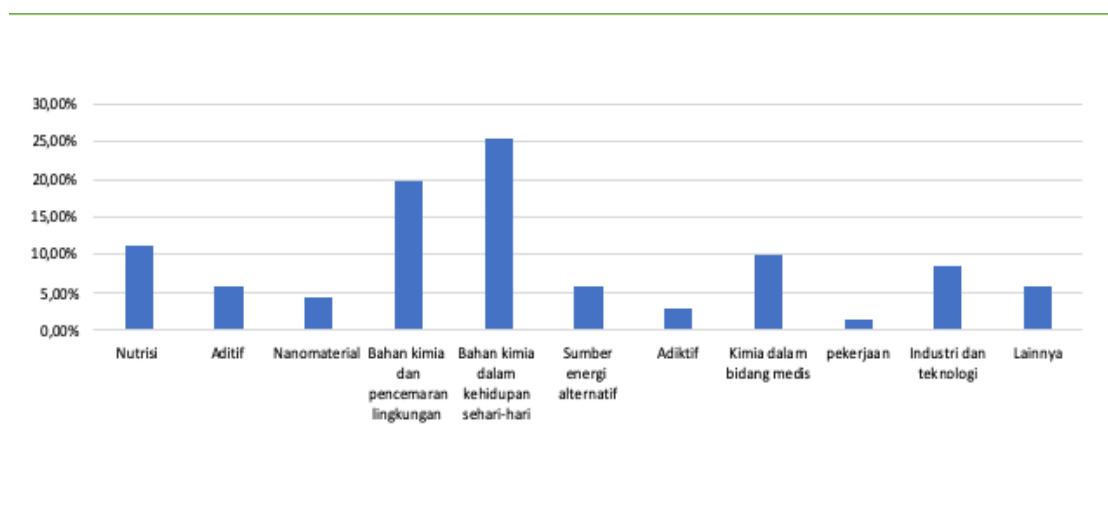


Figure 1. Percentage of Secondary Codes on the Theme "SSI Topics"

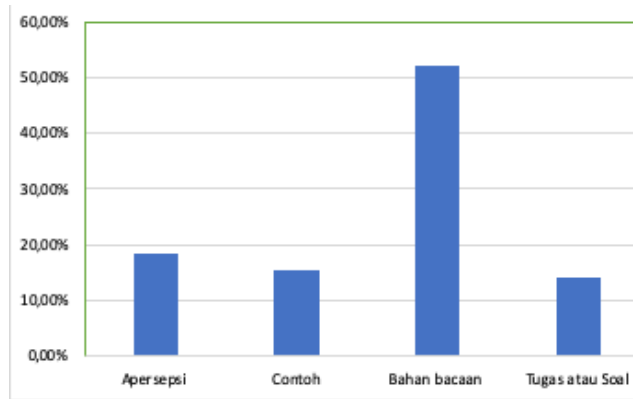


Figure 2. Percentage of Secondary Codes on the Theme “Stages of Presentation”

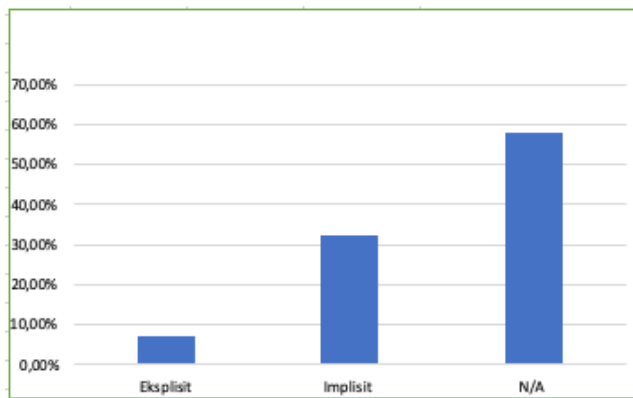


Figure 3. Percentage of Secondary Codes on the Theme “Level of Presentation”

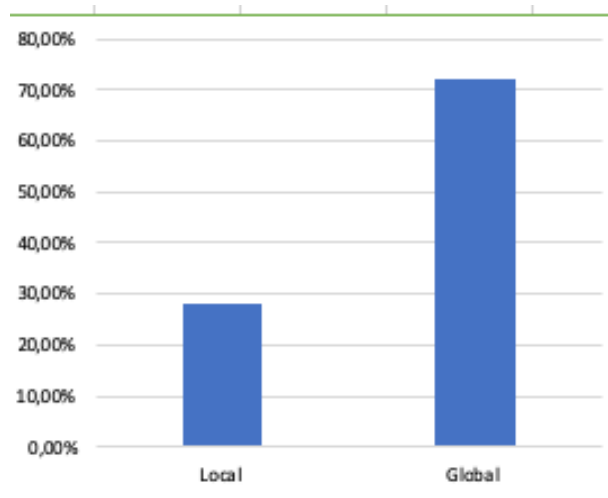


Figure 4. Percentage of Secondary Codes on the Theme “Aspects of SSI”

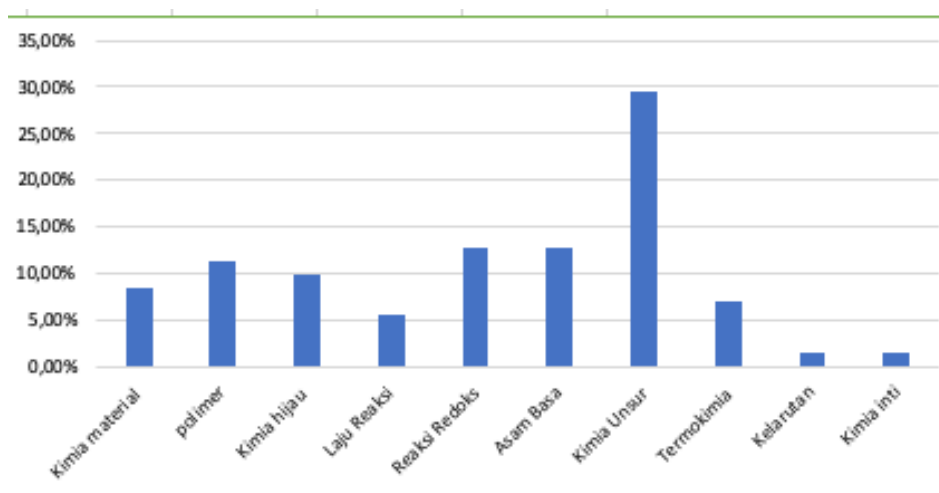


Figure 5. Percentage of Secondary Codes on the Theme “Chemical Concepts”

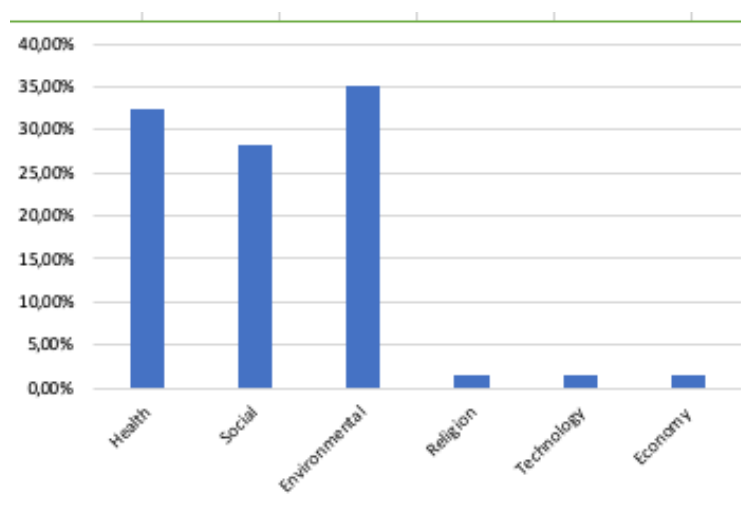


Figure 6. Percentage of Secondary Codes on the Theme “Dimensions of SSI”

Discussion

The theme “SSI Topics” as shown in Figure 1. there are 11 codes that appear. Based on the two books analyzed, there are 18 data that focus on chemicals in everyday life, including topics (chlorine, lithium batteries, disinfectants, fungus poison, microchips, powder enhancers, blowtorches, alcohol germicides, wasted tires, detergents, soap, bromine in fire extinguishers, and oil painting) with a percentage of 25.35%. This is in accordance with research conducted by Calik & Wiyarsi (2021) that chemistry is a science that relates to almost all aspects of life so that many events or events in everyday life can be used as chemistry learning topics. Almost all aspects of our lives are related to chemistry. Learning that involves socioscientific issues (SSI) will be relevant to the context in everyday life (Stuckey et al., 2013). The presence of SSI content in the development of teaching materials such as textbooks has been proven to make chemistry learning more relevant to students (Dishadewi et al., 2020). In the two books analyzed, the most SSI topics were found in level IV chemistry textbooks with a total of 34 data so that level IV chemistry books have higher potential in integrating SSI content in the emergence of topics.

The theme “Stages of Presentation” as in Figure 2. there are 4 codes that appear. Based on the two books, the SSI topics that appear are then grouped into these 4 codes, which include apperception, reading material or material, examples, and questions. The results of the highest percentage that emerged from the two books analyzed showed that most SSI topics were presented in the form of reading materials or materials with a percentage of 52.11% or 37 data. SSI topics that appear in the presentation stage as reading materials or materials, both in core reading and development in the presentation of concepts as additional information have the largest percentage. This result is in accordance with previous relevant book analysis research conducted by (Azkiya, 2023) that the

appearance of a focus of content in the presentation as reading material in textbooks so that it has an important role in the progress of learning. However, in the two textbooks analyzed, the presentation stage as reading material or material appears more in the development section or additional information so that in this reading there is still not much that relates SSI directly.

The theme “Level of Presentation” as shown in Figure 3. there are 3 codes that appear, namely N/A, implicit and explicit. SSI topics that appeared in both textbooks were then grouped into the 3 presentation level codes. The results obtained on the presentation level theme, the most SSI topics appear in the N/A code with a percentage of 57.65%. The presentation level of SSI in N/A is a presentation that is not focused by the author, meaning that there is no direct mention of SSI content in it. This N/A presentation of SSI can make the author unaware that what has been read is actually an SSI topic. Usually the book author will make it in the form of examples only at this N/A presentation level. This result can certainly be a consideration for the author to make textbooks in the future so that more appear at the implicit or even explicit level. The textbook itself is the main learning tool for students as well as teachers. SSI-based textbooks can significantly improve students' chemical literacy (Rostikawati & Anna, 2016).

The theme “SSI Aspects” as shown in Figure 4. there are 2 aspects that appear, namely local and global aspects. Grouping into these two aspects is done based on the SSI topics that appear in chemistry textbooks level IV and V. Based on Figure 4, it can be concluded that the SSI topics included in the global aspect code are 51 data or 71.9% and those included in the local aspect code are 20 data or 28.1%. These results are in line with previous research that research on SSI has been widely conducted in the world. The application of SSI is very diverse in various countries and cultures. However, problems related to SSI that arise in one country do not necessarily occur in other countries (Yahya et al., 2012).

The theme “Chemical Concepts” as shown in Figure 5. there are 10 codes that appear. The existence of SSI chemistry concepts that appear makes students feel that the chemistry learned at school is relevant to everyday life. The relevance of these issues can make students have an interest in chemistry on a macroscopic, microscopic, and symbolic scale (Dishadewi et al., 2020). Based on Figure 5. chemical concepts that appear in both books, namely material chemistry, polymers, green chemistry, reaction rates, redox reactions, acid bases, elemental chemistry, thermochemistry, solubility, and core chemistry. Chemical concepts with the highest percentage appear in the concept of elemental chemistry as much as 21 data with a percentage of 29.57%. The use of elemental chemistry materials can be seen as easily accessible and applied to SSIs that focus on chemistry. In addition, other SSI topics appear in the concepts of green chemistry and acid-base. The emergence of SSI topics on the concept of green chemistry focuses on the development of chemical processes and products that are more environmentally friendly, more sustainable, and have a lower negative impact on the environment (Karpudewan et al., 2012). The chemical concepts that appear in these two books are associated with other chemical concepts that are still related to these topics which are carried out on the theme “Other Related Chemical Concepts”.

The theme “Dimensions of SSI” as shown in Figure 6. there are 6 theme codes that appear. The SSI topics that appeared in both textbooks were analyzed based on which dimensions. Three dominant dimensions emerged, namely health, social and environment. The social dimension is one of the most prevalent because social issues are an important element of SSI because they involve aspects of relationships, interactions, and values in society. When dealing with socioscientific issues, it is important to consider the impact on society as a whole and the groups involved (Azkiya, 2023).

This research analyzing high school chemistry textbooks level IV and V in Malaysia can provide implications for the education curriculum in Indonesia, one of which is as a comparative study of similar research that has been done before. Seeing that the education curriculum in Malaysia strongly integrates STEM in it related to SSI as one of the efforts in shaping students as learners in the 21st century. In addition, this study can also see that it turns out that the curriculum design applied affects the content, one of which is the teaching materials used such as textbooks.

CONCLUSION

Based on the research that has been done, it can be concluded that:

1. The number of occurrences of SSI in terms of topics in high school chemistry textbooks level IV and V in Malaysia is 71 data. The most SSI topics are found in chemistry textbook level IV.

2. The number of occurrences of SSI in terms of presentation stages in chemistry textbooks level IV and V in Malaysia is 71 data with the code as reading material or material appearing the most amount of 37 data with a percentage of 14.1%.
3. The number of occurrences of SSI in terms of presentation level in chemistry textbooks level IV and V in Malaysia is 195 data with the code N/A appearing the most at 41 data with a percentage of 57.75%.
4. The number of occurrences of SSI in terms of SSI aspects in chemistry textbooks level IV and V in Malaysia is 71 data with the global aspect code appearing the most at 51 data at 71.9%.
5. The number of occurrences of SSI in terms of chemical concepts in chemistry textbooks level IV and V in Malaysia is 142 data.
6. The number of occurrences of SSI in terms of the dimensions of SSI in high school chemistry textbooks level IV and V in Malaysia is 213 data with the highest percentage appearing in the environmental dimension of 35.21%.
7. The mapping of chemical concepts that can be integrated with SSI topics found in chemistry textbooks level IV and V in Malaysia is 93 data.

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