

Character education content in science textbook for senior high school students

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ABSTRACT

Student textbooks need to contain character education following curriculum objectives. This study aimed to describe the character content in high school science textbooks 10th-grade, analyze the distribution of character content on each topic, and identify similarities in each textbook. The research objectives were answered by inferential content analysis. The books analyzed were two textbooks (one published by the government and one published by a private company). The results showed that both textbooks contained dimensions of the Pancasila student profile presented explicitly and implicitly. The analysis showed that the character content in book 1 was 262 and in book 2 was 463. Book 1 is dominated by critical reasoning (39%) and book 2 is dominated by independence (34%). The distribution of characters on each topic in the two books is different, but both books contain all dimensions of the character profile of Pancasila students. The results of this study are considered for teachers to use various books and learning resources in learning. In addition, the results of this study also provide initial information for future researchers to develop a mechanism for measuring the profile of Pancasila students as a feature of the Independent Curriculum.

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1. INTRODUCTION

The development of science and technology influences the development of education. This development in education is reflected in curriculum changes that seek to adapt to developments in science and technology [1], culture, and changing societal needs [2]. This curriculum and pedagogical development are solely to help students have strength as a preparation for life in the future [3]. In the last decade, primary and secondary education curricula have transformed in various countries, including the United States, China, Zimbabwe, South Africa, Cyprus, and Siberia [4]–[10].

Indonesia is a country that continues to improve the quality of education by adapting its curriculum to the times. In 2019-2022 Indonesia underwent a major curriculum reform. The conditions of the COVID-19 pandemic, which made it impossible to carry out face-to-face learning at schools, caused the change in the K-13 national education curriculum to an emergency curriculum [11], [12]. Furthermore, in 2021 this emergency curriculum will develop into a prototype curriculum. In 2022, the prototype curriculum will be designated as the Independent Curriculum or “Kurikulum Merdeka” which will be implemented in stages for the recovery of the learning crisis in Indonesia [13]–[15].

Independent Curriculum allows students to study according to their abilities, is free to determine interests in the fields to be studied, and develops a Pancasila student profile. Pancasila student profiles are characters and competencies that will be built in national education [16]. The profile of Pancasila students includes six dimensions: i) having faith, fearing God Almighty, and having noble character; ii) global diversity; iii) mutual cooperation; iv) independence; v) critical reasoning; and vi) creative. These six dimensions have different achievement targets in each educational phase according to the stages of psychological and cognitive development of students.

Pancasila student profiles are targeted characters that students can have. Character education needs to be developed because the involvement of students in their daily community requires readiness for good character, including honesty, open-mindedness, compassion, and nationalism [17]–[19]. Implementation of character education needs to be planned both in learning and non-learning activities and carried out at school and home [20], [21]. The primary foundation for character education in Indonesia is Pancasila [22].

The change of the 2013 curriculum to an Independent Curriculum has impacted changes in Indonesia's learning system. One of them is the change of textbooks. Student textbooks must contain character education through the independent curriculum, namely the Pancasila student profile. The Ministry of Education, Culture, Research and Technology, and other publishers publish Independent Curriculum-based learning textbooks. Textbooks from ministries are published both for teachers and students. This book can be used by adapting, modifying, and adapting it to student needs. The content in textbooks should represent learning outcomes, including character development that students are expected to have, namely the profile of Pancasila students.

The evaluation of character education content in textbooks is carried out by content analysis. In the last 20 years, content analysis research has developed because data access is increasingly open and accessible in the "big data" era [23]. The field of study in content analysis has also developed, starting from education, criminology, and social affairs. Research on book content analysis has been published in many countries in the last five years. Examples include analysis of inquiry-based task content on higher education biology books in China [24], content analysis of science books in Pakistan, pre-service teacher books in Turkey [25], and demographic analysis of textbooks illustrated in American libraries [26]. Even in Indonesia, research on book content analysis is also developing; for example, among others, content analysis of science books for junior high schools in 2013 [27], English books for junior high schools [28], analysis of potential local content in interactive e-books [29], and an analysis of values in the 2013 curriculum-based junior high school Islamic Religious Education book [30].

Analysis of the content of character education has also been carried out before. Most of the analysis of character content was carried out in learning and moral education books [31]–[37], language books (*Bahasa*) [38]–[42], and only a few researchers who analyzed science textbooks (IPA) [43], [44]. However, from content analysis research that has been published, no content analysis of high school science books based on the independent curriculum has been found. Therefore, it is necessary to analyze the content of high school science books, especially in terms of character content.

The content analysis in this study focused on analyzing the character education content of Pancasila students in class X (first grade) high school science textbooks. The study was conducted to answer the following three research questions:

- i) What is the description of the content of character education in class X science textbooks based on the Independent Curriculum?
- ii) How is the distribution of character content on each topic in the class X science textbook based on the Independent Curriculum?
- iii) What are the similarities in the content of the characters of each book?

Analyzing the content of character education in textbooks can be a reference for teachers to find the content of character education in each sub-chapter. It is hoped that the teacher will adapt the existing book according to the demands of the curriculum; if it does not contain Pancasila student values, the teacher can add it. Therefore, the goal of education in the independent curriculum is to realize the development of the Pancasila student profile.

2. METHOD

Identification of character content in class X senior high school science textbooks was carried out by content analysis research. Content analysis is a research technique in which the researcher makes valid inferences using analytical constructs and can be re-examined [45]. Content analysis can be performed on artwork, text, images, sound, maps, symbols, and even data in numbers [46]. Content analysis was carried out using several procedures, namely data procurement, reduction, inference, and analysis.

2.1. Data procurement

Procurement of data begins with the determination of units. The units in this content analysis are topics in science textbooks for class X based on the Independent Curriculum. The books analyzed were determined by purposive sampling technique. The chosen high school science book for class X is a book that contains integrated science subjects in 1 book. In a sense, high school science textbooks printed with separate biology, chemistry, and physics subjects were not categorized as samples of analysis. Based on research, as of November 2022, there were two integrated high school science books, namely books published by the Ministry and books published by the private sector. Therefore, the two books were used as research samples. Before collecting data, the researcher first read and observed the textbook's contents. Then, the researcher recorded or recorded data and findings in a book to facilitate data collection. Data collection in character education content corresponds to describing the dimensions, elements, and sub elements of the Pancasila student profile [16].

2.2. Data reduction and inference

The researcher selects relevant and irrelevant data to the analysis context at the data reduction stage. Furthermore, at the inference stage, the researcher grouped the findings in the book according to the dimensions of the Pancasila student profile. At this stage of inference, it is necessary to be sensitive to the context of the data studied. Developing an analytical construct will provide an operational description of the researcher's knowledge regarding the dependence between data and context [45]. The researcher developed an analytical construct that contained a checklist to classify the findings of the book's contents in the dimensions of the Pancasila student profile and the theory of character education. It is in line with Adi and Astuti [28], which state that a checklist is one of the instruments needed in content analysis.

2.3. Data analysis

Data analysis was carried out following the research objectives: to describe the content of character education in books and see the completeness of character education content on each material topic. The findings that have been classified in the dimensions of the Pancasila student profile are analyzed descriptively quantitatively by calculating the frequency. Furthermore, the frequency of appearance of each dimension of the Pancasila student profile in one book is compared with another. A description of the distribution of character education content and a comparison of character education content between books are visualized in a chart.

3. RESULTS AND DISCUSSION

3.1. Description of the character education content in class X high school science textbooks

Changes in the grade X science subject families from separate biology, chemistry, and physics to integrated science in an independent curriculum impact changes in the textbooks used by teachers. In addition, the goal of the independent curriculum to develop student profiles with the spirit of Pancasila also affects teaching materials, one of which is textbooks. This textbook references high school teachers implementing the Independent Curriculum as a new curriculum.

The book's content in the form of materials, instructions, and learning activities must contain character education developed in the independent curriculum, namely the profile of students who have the spirit of Pancasila. The categorization of book content in the dimension of the profile of students with the spirit of Pancasila was carried out by construct analysis. The results of the content analysis obtained that the character content in book 1 amounted to 262 and in book 2 amounted to 463, with an average of 362.5.

As explained earlier, the Pancasila student profile contains six dimensions, namely: i) faith, devotion to God Almighty, and noble character (D1); ii) global diversity (D2); iii) mutual cooperation (D3); iv) independence (D4); v) critical reasoning (D5); vi) creativity (D6). These six dimensions must be present in every book based on the independent curriculum. In more detail, the percentage content of the Pancasila student profile dimensions in each book is shown in Figure 1. Book 1's dominant dimension is critical thinking (39%) as presented in Figure 1(a). The elements of critical reasoning are obtaining and processing information and ideas, analyzing and evaluating reasoning and procedures, and reflecting on thoughts and thought processes [16]. In contrast to book 1, the dominant character that emerged in book 2 was independent as shown in Figure 1(b). The independent dimension outperformed with a percentage of 34%. Meanwhile, critical thinking came in third.

In book 1, the dominant dimension is critical reasoning. Book 1 contains many activities inviting students to look for important ideas in various sources of information, analyze and evaluate an idea, and provide reasons for their decisions. The description of these activities manifests the elements of the critical

reasoning dimension. An example of content that accommodates the critical reasoning dimension is shown in Figures 2 (a) and (b).

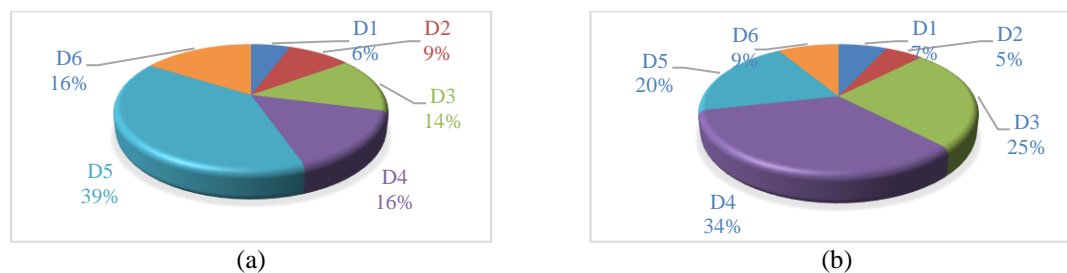


Figure 1. Character load in (a) book 1 and (b) book 2

1. Kesalahan pengukuran yang disebutkan pada paragraf ketiga, kalimat ketiga termasuk dalam kesalahan pengukuran akibat ...

- ☐ Kesalahan acak
- ☐ Kesalahan sistematis
- ☐ Kesalahan paralaks
- ☐ Keterbatasan keterampilan pengamat

Alasan:

Translation:

1. Measurement errors are mentioned in the third paragraph; the third sentence includes measurement errors due to...

- ☐ random error
- ☐ systematic error
- ☐ parallax error
- ☐ limited observer skills

(a)

c. Jika Kalian diberikan 2 kain yang tidak diketahui ukuran seratinya, tentukan benar atau salah aktivitas yang dilakukan untuk mengukur kemampuan memfilter virus corona?

Pernyataan	Benar	Salah
Mengukur diameter serat kain.		
Membandingkan jumlah virus yang tersaring diantara 2 kain tersebut.		
Membandingkan ukuran virus corona dengan pori-pori masing-masing kain.		

Translation:

If given two fabrics of unknown fiber size, determine whether the activity is correct or wrong to measure the ability to filter the coronavirus?

Statement	True	False
Measure the diameter of the fabric fiber		
Comparing the amount of virus filtered between the 2 fabrics		
Comparing the size of the coronavirus with the pores of each cloth		

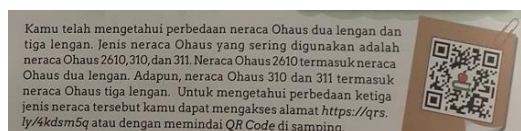
(b)

Figure 2. An example of content that shows (a) students are allowed to analyze and (b) evaluate the reasoning they use in making decisions

In book 2, the publisher provides links that direct students to deepen their knowledge independently through material content, videos, articles, and other learning resources related to the learning topic as shown in Figure 3(a). In addition, in each topic, many activities provide students to present their work in class as shown in Figure 3(b). This supports the growth of self-confidence in students. Self-confidence is a sub element of the self-regulation element in the independent dimension.

In both books, the dimension with the minor frequency is "Faith, devotion to God Almighty, and noble character." This dimension has a broad scope because it contains religious values and noble morals. In these books, the contexts that contain this dimension are student activities that show courtesy so that they understand and respect others as a manifestation of the elements of morals towards humans. In addition, this dimension is also reflected in activities that accommodate students' ability to identify environmental problems and formulate solutions. There is also content that directs students to write down reference sources honestly to support the element of personal morals in the religious dimension.

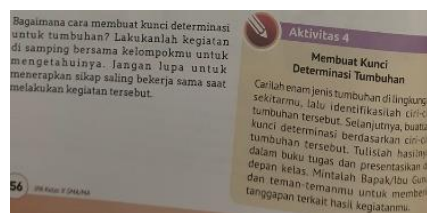
The results showed that book 1 and book 2 contain different character education content. The character content in book 2 from private publishers is more than book 1 published by the government. This finding is helpful for educators as a consideration in designing learning. Teachers can use reference books to facilitate student learning in independent curriculum learning. Teachers can choose several book contents, use more than one textbook, or add other relevant sources to implement learning. The combination of several books and several relevant sources will undoubtedly support the achievement of learning objectives. They are included in achieving the goal of developing a Pancasila student profile. This results is in line with Rona's findings [47] that the use of various sources of teaching materials will encourage active learning, the development of different skills, and the development of students' values and attitudes.



Translation:

You already know the difference between two-handed and three-handed Ohaus balances. The Ohaus scales often used are the Ohaus 2610, 310, and 311 scales. The Ohaus 310 and 311 balances are the three-arm Ohaus balances. You can access the <http://qrs.ly/4kds5q> address or scan the QR code on the side to find out the differences between the three types of balances.

(a)



Translation:

How to make a plant determination key? Do a side activity with your group to find out. Don't forget to apply mutual cooperation when carrying out these activities.

Activity 4.

Make a plant determination key

Look for six types of plants in your environment, then identify the characteristics of these plants. Next, decide key based on the characteristics of the plant. Write the results in your assignment book and present them to the class. Ask Mr / Mrs. Teacher and your friends to provide feedback regarding the results of your activities.

(b)

Figure 3. Example of content containing links (a) to student self-learning tools to develop knowledge and (b) to directs students to present in front of the class to raise self-confidence

3.2. Distribution of character content on each topic in class X science textbooks

In addition to comparing the percentage of dimensions in each book, it is also necessary to compare the character content on each topic in book 1 (B1) and book 2 (B2). Based on the content of learning outcomes, the science material of grade X senior high school is divided into eight core topics. This science textbook is developed based on an independent curriculum so that each topic must accommodate the educational objectives of the independent curriculum, namely the development of a Pancasila student profile. The distribution of character education content on each topic can be seen in Table 1.

Table 1. Character education content for each topic in both books

Topic	D1		D2		D3		D4		D5		D6	
	B1	B2	B1	B2	B1	B2	B1	B2	B1	B2	B1	B2
Measurement in scientific work	1	2	2	6	2	13	8	15	19	11	8	4
Viruses and their role	2	2	0	1	2	16	6	22	15	11	4	6
Green chemistry in sustainable development 2030	6	5	4	2	5	11	3	11	7	7	6	2
The basic laws of chemistry around us	1	1	8	0	9	12	5	20	14	13	4	1
Atomic structure – advantages of nanomaterials	0	1	5	5	10	12	2	18	9	10	8	4
Renewable energy	1	2	0	2	1	13	7	14	12	9	4	8
The diversity of living things, their interactions, and their role in nature	1	6	2	4	3	18	6	32	14	13	5	5
Global warming: concepts and solutions	3	13	3	5	5	23	4	24	13	18	3	10
Total	15	32	24	25	37	118	41	156	103	92	42	40

Table 1 shows that almost all topics in both books contain the character profile of Pancasila students. The number of characters contained in each topic varies. Based on the data, it is known that both book 1 and book 2 accommodate the development of Pancasila student characters. Topics with biology themes, such as viruses and their roles, diversity of living things, and global warming, contain more content that integrates the dimensions of the Pancasila student profile. This finding can be a consideration for teachers in implementing learning to improve further the content of the Pancasila student profile on other topics that are still low.

The distribution of Pancasila student profile dimensions is uneven in each topic (Table 1). Some dimensions are dominant in certain topics, but some do not contain any dimensions of the Pancasila student profile. Based on Table 1, it is known that almost all topics in both books contain the dimensions of the Pancasila student profile. However, there are some topics with dimensions that have not been integrated as presented in Table 2.

In tracing the distribution of character content on each topic, information was obtained that in book 1 and book 2, the character content in the dimension of faith and devotion to God Almighty and noble character and the dimension of global diversity was still low. Some topics contain both dimensions. Therefore, increasing activities or instructions that develop these dimensions is necessary. The characteristics of piety and noble character must be developed in learning [48], [49].

Table 2. Character education content that has not been integrated into each topic in the two books

Book	Material topics	Unintegrated dimensions
Book 1	Atomic structure – advantages of nanomaterials	Faith, fear of God Almighty, and noble morals
	Viruses and their role	Global diversity
	Renewable energy	Global diversity
Book 2	The basic laws of chemistry around us	Global diversity

3.3. Similarities in character content in textbooks

The results of content analysis research show that the number of comparisons of Pancasila student profile dimensions in book 1 and book 2 is different (Table 1). In general, both science books for students in the independent curriculum contain character education (dimensions of the Pancasila student profile). The amount of character education content will certainly affect the achievement of the Pancasila student profile for high school students. Books with high character education content can encourage the realization of students who have quality Pancasila characters. This finding aligns with previous research that to support quality learning, books with adequate character content are needed [37], [44], [50].

Character education approaches are categorized into three: cognitive approach, affective approach, and comprehensive approach. The cognitive approach developed by Kohlberg is rooted in Piaget's theory, namely that moral decisions are a natural process of cognitive development [51], [52]. Affective assessment has become an important aspect of school programs [53]. This affective approach involves students' feelings. Attitudes, interests, values, emotions, and appreciation positively influence student behavior. The following approach is comprehensive, a combination of cognitive and affective approaches by Krischenbaum [51]. The comprehensive term used in character education covers various aspects, including personal values and ethics in general [22].

The findings show that the textbook contains character education with a comprehensive approach. This is because the dimensions in the Pancasila student profile develop cognitive aspects such as critical and creative reasoning and affective aspects such as being religious, independent, and mutual cooperation. This is in line with Zuchdi [22], [51], which states that the comprehensive approach used in character education covers various aspects, covering all issues related to personal values towards ethics in general.

The character content analysis conducted by previous studies has not led to a comprehensive approach. In moral textbooks in Malaysia, Tan *et al.* [37] found values of responsibility, respect, helping, hard work, and caring. Tan's findings are more directed towards character content with an affective approach because it emphasizes the emotional aspect. Similar research was also conducted by Han *et al.* [35] on moral learning textbooks in Korea and Japan, which emphasized the affective approach, namely appreciating life.

It is important to have comprehensive character content in textbooks to help build good character. The self-paced curriculum science textbooks have achieved this. The comprehensive character content in these self-paced curriculum-based science textbooks, if implemented in earnest, will also help students have comprehensive abilities. They can use their thoughts and feelings to solve problems. Thus, students can position themselves as human beings who think intelligently, feel humanely, and act wisely.

In general, the results of this study have implications for educators to integrate dimensions in subjects that do not yet contain the dimensions of the Pancasila student profile in them. High school science lessons are conducted separately, biology subjects are taught by biology teachers and chemistry subjects are taught by chemistry teachers. Teachers need to plan learning together so that the Pancasila student profile can be optimally accommodated.

4. CONCLUSION

Student textbooks must contain character education through an independent curriculum, namely the Pancasila student profile. The results showed that in book 1 there were 262 and in book 2 there were 463. Book 1 is dominated by critical reasoning and book 2 is independent. The distribution of characters on each topic in the two books is different. The characters integrated into learning on each topic differ in book 1 and book 2. Both books contain the dimensions of the Pancasila student profile in full, which means that the books use a comprehensive approach in their character education content. The findings of this study can be taken into consideration for teachers to use various books and relevant learning resources in learning to support the achievement of the Pancasila student profile. Further research that can be done as a follow-up to the results of this study is an evaluation of learning that implements an independent curriculum. Evaluation of this implementation needs to see the profile of Pancasila students who have learning outcomes.

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