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The analysis of science textbooks: science-chemistry teachers' book and students' book of junior high school

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Abstract. This study aims to analyse the science textbooks for teachers and students of junior high school students. The method used in this research is a qualitative method that used text analysis as a content analysis. The issue of school science textbooks has been a major research topic within the science education research tradition. The analysis of textbooks is divided into three formality values, namely: terminology and notation, nominalisations, and the use of passive voice. The categories of terminology and notation for teachers' book and students' book showed the result of high (H) value, the nominalisations for teachers' book and students' book also showed the result of high (H) value. Meanwhile, the use of passive voice for teachers' book and students' book showed the result of a low (L) value. By nominalising verbs in writing, more information can be packed into each clause so that the noun phrases can extend and carry more content. On the other hand, the analysis showed the result of low value in the use of passive voice while the verbs in passive voice appeared less than the verbs in the active voice. The result also showed weak power relationship and weak involvement in both textbooks. The weak power (hierarchical) relationship was shown by more occurrences of interrogatives and declarative rather than imperatives in both textbooks. Meanwhile, the weak involvement was shown by the frequency of the use of personal pronouns (more use of plural personal pronouns than singular ones). In conclusion, the analysis in both Chemistry textbooks (teachers' book and students' book) in the content of acid and base was high value in the formality markers of both terminologies, notation, and the nominalisations.

1. Introduction

The curriculum as a set of educational plans should be developed dynamically by the demands and changes that occur in society. All Indonesia's national curricula were designed based on the same foundation, namely *Pancasila* (Philosophical foundation of the Indonesian Republic) and the 1945 Constitution of the Republic of Indonesia; the principal differences among those curriculums were only on emphasising educational goals and approaches to realise it. The national curriculum of Indonesia had changed several times, more than ten times in precisely, such as curriculum before colonial until after independence. Those alterations are logical consequences of a political issue, government system, social culture, economic, and science technology in the community [1], [2]. Furthermore, the last version was the curriculum 2013 with several revisions on basic competencies and the evaluation instructions until 2018. In curriculum 2013, the government developed the textbook as the resources in teaching and learning in the school.

Textbooks are one of the essential factors to the shaping of teachers, students, and families to a view of the school subject [3], [4]. Moreover, the science and mathematics textbook have a significant effect on classroom practice and has a correlation with curriculum [4]. Consequently, the content and

the feature of the textbook become a specific vision of the curriculum. Based on the curriculum 2013, the government of Indonesia released two kinds of the textbook, namely teachers' textbooks and students' textbook. Students' textbook is the main resource to achieve the basic competencies and core competencies; meanwhile, the teachers' textbook is the guideline which includes the teaching and learning strategy, a model of teaching and learning, the technique of learning, and the evaluation for every courses or theme of learning. The textbook is a part of the tools of teaching, which has the closest material for students to achieve the knowledge.

Moreover, it is almost impossible for a student to obtain a high level of education without textbooks [5]. The essential factors for a student to achieve knowledge is the capability for reading, writing, and speaking, especially in the science area [6]. However, the understanding of reading, writing, and speaking of the content of the textbook is not easy, especially for a science textbook. Because science textbooks have several differences in technical and unique vocabularies. It also in technical science terms, abbreviation, alphabetical, notational signs, and graphical signs with other textbooks [7], [8]. Furthermore, the language of science and the language of school science is different. The language of science is textured and structured; meanwhile, the language of school science resembles the language of science textbooks [6]. This research is slightly very few in the science field, especially in the science education department, even though the lectures and government are often used this textbook as references for teaching in the classroom. It should have a good analysis which the content was proper with the students' knowledge. Therefore, it can construct new ways for making the content of the science-chemistry textbook.

This article aims to analyse the formality value of science textbooks for teachers and students in junior high school, especially for chemistry textbooks with the basic competency of acid and base. The formality value forms the terminology and notation; nominalisations; and use of the passive voice.

2. Method

The qualitative method is utilised in this research with teachers and student's science textbook analysis as a content analysis. Qualitative content analysis is one of the various qualitative methods available for analysing and interpreting the data [9]. This analysis has proper to analysis the science-chemistry textbook because, by several questions, the researcher can conduct a more in-depth analysis of textbooks, such as the terminology and notation, nominalisations, and the use of passive voice. There are six questions must be addressed in every content analysis, such as which data are analysed, how are the data defined, from what population is data drawn, what is the relevant context, hat are the boundaries of the analysis, and what is to be measured [10]. In this research, there are two types of the science-chemistry textbook, namely teachers' science-chemistry textbook and students' science-chemistry textbook.

The first way to analyse the textbooks is Unitization. This step is looking for any images, cover, which level the textbook is used, the narrative text. The second step is data selection. The step is classifying the elements, which related to formality value. Operationalised is the next step which explaining the images or statements. Next step is coding. The coding is the symbol to emphasise the keyword from the explanation. For instance, H is the symbol for high and have explained that the nominalisation has three or more noun. The last step is data analysis and reporting [10].

3. Result and Discussion

The issue of school science textbooks has been a major research topic within the science education research tradition. The analysis of science textbooks can be seen in table 1.

Table 1. The Result of Teachers' Book and Students' Book Analysis

Acid and Base Formality value	Teachers' Book Code	Students' Book Code
a. Terminology and notation	High	High
b. Nominalisations	High	High
c. Use of passive voice	Low	Low

According to the table, the content analysed was chemistry subject in the science textbook for the seventh grade of junior high school in Indonesia. The content was about acid and base. The sociolinguistic aspects of formality value were analysed in both teachers' book and students' book [11]. Some arrangements categorised the division of formality and can be seen in table 2.

Table 2. Formality markers of the linguistics code

	Arrangement of Formality Value (combinations of marker)
High	High- High- High- High
	High- High- High-Moderate
	High- High- High-Low
	High- High-Moderate-Moderate
Moderate	Moderate- Moderate- Moderate-High
	Moderate- Moderate- Moderate-Moderate
	Moderate- Moderate- Moderate-Low
	High- High-Low-Moderate
	High- High-Low-Low
	Low-Low- High-Moderate
Low	Low-Low- Low- High
	Low-Low- Low-Moderate
	Low-Low- Low-Low
	Moderate-Moderate-Low-Low

Formality corresponds to the degree of abstraction, elaboration, and specialisation of the linguistic code employed. Low formality corresponds to a linguistic code resembling very much the vernacular. On the contrary, high formality corresponds to the specialised linguistic code that follows the conventions that scientific experts use when communicating through this code. Science uses a specialised linguistic code. This kind of code is not an external feature of science but constitutes an intrinsic characteristic for the construction of the scientific discourse [7].

Table 3. The three-domain of formality markers analysis

Formality Markers of the Linguistic Code		
Terminology and notation	Nominalisations	Use of passive voice
High = appearance of terms, symbols, and equations	High = existence of nominal groups of three or more nouns	High = prevalence of verbs in the passive voice
Moderate = appearance of two elements (e.g., symbols and equations)	Moderate = existence of nominal groups of two nouns	Moderate = verbs in a passive voice almost equal with verbs in an active voice
Low = appearance of only one element (e.g., only terms)	Low = no nominal groups	Low = verbs in a passive voice less than the verbs inactive

Fundamental realisations of the specialised character of the scientific linguistic code (formality) are: (1) the specialised terminology and notation which can be classified into the categories of 'terms,' 'symbols' and 'equations,' (2) the use nominalisations which are very frequently used in scientific language because they: (a) facilitate reference to the taxonomy of various entities, (b) enhance the compressive expression of complex information, (c) allow the smooth development of arguments and (d) allow the formation of novel conceptual entities [12], [13], (3) the heavy use of the passive voice which represents the objective and non-personal character of scientific knowledge.

Table 4. The example of formality markers in science textbooks

	Formality Markers of the Linguistic Code	
	The teachers' Science-chemistry textbook	The students' science-chemistry textbook
Terminology and notation	Symbol: SO_2	Symbol: NO
	Term: the gas of Nitrogen dioxide	Term: Aluminium hydroxide
	Equations:	
	$HCl + NaOH \rightarrow NaCl + H_2O$	Equations:
		Asam + basa $\rightarrow$ garam + air
Nominalisations	Burn become burning	Different become difference
	Investigate become investigation	Observe become observation
Use of passive voice	The reaction of neutralisation *can be implemented* in many fields	A lot of kinds of a plant can be used as a natural indicator

The result of the analysis in both Chemistry textbooks within the content of acid and base was described as showing high value in the formality markers of terminology and notation (shows the appearance of terms, symbols, and equations) and nominalisations (describes the existence of nominal groups of three or more nouns) in both teachers' book and students' book. By nominalising verbs in writing, more information can be packed into each clause so that the noun phrases can extend and carry more content [14], [15]. On the other hand, the analysis shows the result of low value in the use of passive voice while the verbs in passive voice appear less than the verbs in the active voice. The result also showed weak power relationship and weak involvement in both textbooks. The weak power (hierarchical) relationship was shown by the more occurrence of interrogatives and declarative rather than imperatives in both textbooks; meanwhile, the weak involvement was shown by the frequency of the use of the personal pronouns (plural persons are more than a singular person).

4. Conclusion

In terms of textbook analysis for science (chemistry) for both students and teachers in junior high school, there are three formality values such as the terminology and notation, nominalisations, and the use of passive voice. The formality value also has a correlation with linguistic code. The categories of terminology and notation for teachers' book and students' book showed the result of high (H) value, the nominalisations for teachers' book and students' book also showed the result of high (H) value; meanwhile, the use of passive voice for teachers' book and students' book showed the result of low (L) value. The formality markers of the linguistics code were described in the range of High, Moderate, and Low. The high shows that the high formality corresponds to the specialised linguistic code with the existence of nominal groups of three or more nouns; meanwhile the low shows that the formality has many vernaculars with no nominal noun.

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