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Analysis of Chemistry Learning Outcomes Merdeka Curriculum on Basic Law of Chemical Phase E SMA/MA

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Abstrak

Kurikulum yang berlaku saat ini di Indonesia yaitu kurikulum Merdeka. Guru belum memahami capaian pembelajaran yang ada pada kurikulum Merdeka dan hirarki materi pada buku IPA Fase E terbitan Kemendikbud sehingga kesulitan dalam proses pembelajaran. Oleh karena itu, penelitian ini bertujuan untuk mendeskripsikan capaian pembelajaran, tujuan pembelajaran, dan hirarki materi hukum-hukum dasar kimia. Jenis penelitian ini ialah deskriptif dengan pendekatan kualitatif. Teknik analisis data yang digunakan yaitu model interaktif *Miles and Huberman*. Hasil penelitian yang diperoleh adalah: (1) capaian pembelajaran yang terdapat pada BSKAP 033 tahun 2022 terdapat tiga macam, (2) perumusan capaian pembelajaran menjadi tujuan pembelajaran menggunakan alternatif 3 yaitu lintas elemen capaian pembelajaran, (3) hirarki materi perlu rujukan dari ruang lingkup materi capaian pembelajaran dan standar isi agar tidak terjadi tumpang tindih antar materi.

Kata kunci: *Kurikulum Merdeka, Capaian Pembelajaran, Hukum-Hukum Dasar Kimia*

Abstract

The current curriculum in Indonesia is the Merdeka curriculum. Teachers do not understand the learning outcomes in the Merdeka curriculum and the hierarchy of material in the Phase E science book published by the Ministry of Education and Culture, making it difficult in the learning process. Therefore, this study aims to analyze the learning outcomes, learning objectives, and material hierarchy of the basic laws of chemistry. This type of research is descriptive with a qualitative approach. The data analysis technique used is interactive model Miles and Huberrman. The research results obtained are: (1) There are three kinds of learning outcomes contained in BSKAP 033 in 2022, (2) the formulation of learning outcomes into leaning objectives uses alternative 3, namely across learning outcomes elements, (3) the hierarchy of material needs to refer to the scope of learning achievement material and content standards so that there is no overlap between materials.

Keywords: *Curriculum Merdeka, Learning Outcomes, Basic Law Of Chemistry*

INTRODUCTION

According to Undang-Undang number 20 of 2003, the curriculum is a set of plans and arrangements regarding the objectives, content, and learning materials as well as the methods used as guidelines for organizing learning activities to achieve certain educational goals (Iskandar, 2019). As a result of technological, economic, political, and social developments in Indonesia, the curriculum continues to change (Sadewa, 2022). The government offers three curriculum options for education units in the current school year, namely the Curriculum 2013, the emergency Curriculum (simplified curriculum 2013), and the Curriculum Merdeka (Muhammedi, 2016).

Based on Kepmendikbudristek number 56 of 2022 concerning Guidelines for Curriculum Implementation in the Context of Learning Recovery, the current curriculum in Indonesia is the curriculum Merdeka which is an improvement due to learning loss from the

curriculum 2013 caused by the covid-19 pandemic (Mendikbudristek RI, 2022). The Merdeka Curriculum has many variations in classroom learning, this is so that students have enough time to learn concepts and strengthen competencies (Khoirurrijal et al., 2022). However, teachers have not been able to understand the implementation of the curriculum Merdeka as a whole due to the lack of training provided, which has an impact on teacher readiness (Ruhaliah, 2020).

The learning process is known as learning outcomes (CP), which are standards for the curriculum Merdeka based on the Decree of the Education Standards, Curriculum and Assessment Agency number 033 of 2022. CP is the learning competencies that students must achieve at each phase. Competencies or CP's in the curriculum Merdeka are no longer set every year, but every phase. This is expected to help teachers to be more flexible in designing learning paths according to the needs of students.

There are three types of learning outcomes for SMA/MA chemistry subjects in the regulations that regulate them, namely chemistry CP; CP per phase consisting of Phase E and Phase F; CP per element. The elements possessed in each CP are elements of chemical understanding and elements of process skills. Because there are various CP's in one subject, educators must learn CP's thoroughly about the subject they teach. Educators must know what to teach, regardless of whether they will create their own curriculum, flow of learning objectives, or syllabus. However, CP's lack the specificity to direct day-to-day learning. CP should be broken down into more concrete and operational learning objectives, which are individually acquired by learners until they reach the end of the phase (Anggraena et al., 2022).

After understanding CP, educators need to prepare learning objectives (TP) that will be completed in one phase. Learning objectives are a description of the achievement of three aspects of competence, namely knowledge, skills and attitudes that students acquire in one or more learning activities. The learning objectives that have been formulated will be sequenced systematically and logically from the beginning to the end of the phase called the flow of learning objectives (ATP). ATP is arranged in a linear, one-way, non-branching manner, as is the sequence of learning activities from day to day (Anggraena et al., 2022).

Based on a questionnaire to 10 high school teachers who have implemented the Merdeka curriculum in Padang regarding their understanding of the Merdeka curriculum and CP, 80% of teachers have problems in understanding the CP itself and reducing the CP to learning objectives (TP), and 70% of teachers stated that the Ministry of Education and Culture's published chemistry books were not in accordance with the hierarchy of material content in CP. This will certainly have an impact on the implementation of learning so that teachers need document recommendations in the form of learning objectives and material content hierarchy. Therefore, this research was conducted to be able to produce an analysis of CP on chemical understanding and process skills and how the hierarchy of material content.

Research related to the analysis of curriculum achievements has already been done, namely in the 2013 curriculum by Khorunnisah. The results of the study are related to core competency 3 (KI 3) of the 2013 Curriculum in class XI SMA / MA based on the revised Bloom taxonomy. There has also been research related to structure and content analysis, namely Sophia Elvira by analyzing the basic chemical law material in the Merdeka curriculum. However, no one has analyzed the achievements of the Merdeka curriculum specifically in SMA / MA chemistry subjects.

Thus, it is necessary to analyze the learning outcomes of SMA / MA chemistry for Phase E or grade X of the Merdeka curriculum on the material of the basic laws of chemistry. The analysis was also carried out on the content hierarchy of the material using the James Brady 7th Edition book. Where this analysis is an activity of decomposing material into its constituent parts and determining how these parts are related to each other with the overall structure and purpose (Anderson et al., 2001).

METHOD

The type of research used is descriptive research with a qualitative approach. Data collection techniques using literature studies and questionnaires. The data sources of this research are Kepmendikbud number 56 of 2022, BSKAP number 033 of 2022, Permendikbud number 5 of 2022, Permendikbud number 7 of 2022, Permendikbud number 16 of 2022, Permendikbud number 21 of 2022, standard textbooks, books published by Kemendikbud. The data described in this study is an analysis of chemical understanding and process skills of the independent curriculum on the material of the basic laws of chemistry phase E SMA / MA. The data analysis techniques used are differentiating, organizing, and finding implied messages.

RESULT AND DISCUSSION

Analysis means the process of breaking down a problem or object into its elements and determining how they are interrelated. Analysis is divided into three stages, namely distinguishing, organizing, and finding implied messages (Anderson et al., 2001). This study aims to describe the analysis of chemistry learning outcomes (CP) in the form of chemical understanding elements and process skills listed in one of the Merdeka curriculum regulations, namely the Decree of the Head of the Education Standards, Curriculum and Assessment Agency Number 033 of 2022 concerning Learning Outcomes in Early Childhood Education, Primary Education Level, and Secondary Education Level in the Merdeka Curriculum. After analyzing the CP, then formulate learning objectives (TP) and these objectives are sorted into a flow of learning objectives (ATP). Material hierarchy analysis is carried out based on the breadth and depth of the material. The results of this analysis are poured into a macro structure and get daily learning objectives.

Analysis of Chemistry Learning Outcomes

Learning outcomes (CP's) are learning competencies that must be achieved by students in each phase. The competencies in question are knowledge, skills, and attitudes written in the form of paragraphs in the CP (Anggraena et al., 2022). BSKAP Decree number 008 of 2022 is a regulation governing CP, but it was updated by BSKAP Decree number 033 of 2022. The only changes that occurred in the two regulations were in appendix III regarding CP for SMK/MAK and appendix IV regarding CP for SDLB, SMPLB, SMALB. Meanwhile, the CP for SMA/MA is in appendix II and has not changed.

The CP script consists of rationale, objectives, characteristics, and achievements per phase. The rationale explains the importance of learning the subject and its relation to the learner profile of Pancasila. Objectives explain the abilities or competencies that are intended after learners learn the subject as a whole. Characteristics explain what is learned in the subject, the elements or domains (strands) that make up the subject and evolve from phase to phase. The phase-by-phase outcomes are presented in the form of overall and phase-by-phase outcomes for each element. Therefore, it is important for educators to learn the CP for their subject as a whole (Anggraena et al., 2022).

In BSKAP which regulates CP, for chemistry subjects, three CP scripts are found, namely overall chemistry CP; CP per phase consisting of Phase E and Phase F; and CP per element consisting of chemical understanding elements and process skills elements. Each of these CPs has different components, including the following.

Table 1. Analysis results of three CP chemistry text

Learning Outcomes	Chemical Understanding	Process Skills	Attitude
Chemistry	√	√	-
Phase E	√	√	√
Element	√	√	-

The knowledge components in the three CPs are different. CP chemistry as a whole contains material content for Phase E and Phase F. CP per phase specifically for Phase E contains material content of physics, chemistry, and biology because in Phase E the three subjects are merged into one, namely natural science (IPA) subjects. CP per element contains material content specific to chemistry subjects studied during one phase, namely Phase E. In overall chemistry CP and CP per element have the same material content for Phase E, but in CP per phase only raises 4 of 6 material contents, namely, chemical concepts in everyday life, green chemistry, global warming, atomic structure and nanotechnology. Chemical reactions and basic laws of chemistry do not appear in the CP per phase. However, there is still phase E material contained in the content standards but does not appear in the CP, namely, principles and rules in electron configuration, valence electrons, and the periodic system of elements.

The skill components in the three CPs also have some differences. The skill competencies contained in the overall chemistry CP and CP per element have the same sentence and the same number, namely from observing, questioning and predicting, planning and conducting investigations, processing and analyzing data and information, evaluating and reflecting, communicating results. However, the skill competencies in the CP per phase are different, which contains only 5 competencies in the form of identifying, proposing ideas, designing solutions, making decisions and communicating. Only one skill competency is explicitly the same from all three CPs, namely communicating. However, if we read the description information of each skill competency in chemistry CP as a whole and CP per element, different skill competencies from CP per phase are also implicitly summarized in it.

The attitude component is found in the CP per phase, namely honest, objective, critical reasoning, creative, independent, innovative, mutual cooperation and global diversity. In the overall chemistry CP and CP per element there is no mention of the attitude component. While the character and general competencies to be developed are stated in the Pancasila learner profile separately (Anggraena et al., 2022).

Analysis of CP Formulation into Learning Objectives (TP)

After understanding CP, educators need to prepare learning objectives (TP) that will be completed in one phase. Learning objectives are a description of the achievement of three aspects of competence, namely knowledge, skills, and attitudes that students acquire in one or more learning activities. In formulating CP, there are 3 alternatives that can be followed, namely; (1) formulating learning objectives directly from CP; (2) formulating learning objectives by analyzing the 'competencies' and 'scope of material' in CP; (3) formulating learning objectives across CP elements. This research uses alternative 3 in formulating learning objectives (Anggraena et al., 2022).

In alternative 1, formulating learning objectives directly from learning outcomes is less appropriate for chemistry subjects. This is because a lot of material content from chemistry is camouflaged, not only for Phase E but also in Phase F. Some of the material listed in the content standards is not presented in the CP, be it the overall chemistry CP, CP per phase, or CP per element.

In alternative 2, formulating learning objectives by analyzing 'competencies' and 'scope of material' is also less appropriate for chemistry subjects. The CP of chemistry subjects consists of two elements, namely the chemical understanding element and the process skills element. If the TP formulation only uses competencies and the scope of the material, then the skill component in the process skills element does not appear. It is different if in other subjects such as Phase D math, which does not separate understanding and skills in CP. Whereas in the Merdeka curriculum, understanding and skills are inseparable.

In alternative 3, namely formulating learning objectives across CP elements. This method is the right way to formulate the TP for chemistry subjects because both elements will participate in one TP. So that the TP contains understanding, skills and is also complete with the attitude component. Here is the TP that has been formulated related to the topic that

has been taken, namely "being able to observe; question and predict; plan and conduct investigations; process, analyze data and information; evaluate and reflect; communicate results in applying the basic laws of chemistry honestly, objectively, reason critically, creatively, independently, innovatively, cooperatively, and with global diversity."

Once the learning objectives are obtained, the next step of lesson planning is to sequence the objectives into a flow of learning objectives (ATP). The ATP serves the function of planning and organizing learning and assessment in outline for a period of one year. The ATP also needs to be organized in a linear, one-way, and non-branching manner, as the sequence of learning activities from day to day (Anggraena et al., 2022).

Analysis of Content Hierarchy Basic Laws of Chemistry

The material hierarchy analysis aims to see the suitability of the material in the Kemendikbud book with scientific principles. Material hierarchy analysis is carried out by analyzing the breadth and depth of material. According to Setiawan (2018), the breadth of material relates to the amount of material content in the textbook based on predetermined subject matter, while the depth of material relates to the concepts that must be learned by students.

The high school chemistry book is used as a limitation of the breadth of material so that the material studied is in accordance with high school material, while the standard textbook is used to see and adjust the order of the depth of material. The results of the breadth and depth analysis are then formed into a macro structure. After knowing the sequence of material and macro structure, it was found that more detailed daily learning objectives emerged to lead learning activities from day to day.

The findings in this study are that in the Phase E Science book published by the Ministry of Education and Culture, chemical reaction material and basic laws of chemistry are combined in one chapter, namely in chapter four 'Basic Laws of Chemistry Around Us'. There are 3 subchapters, namely, (1) characteristics, types, and how to write chemical reactions; (2) four basic laws of chemistry; (3) basic laws of chemistry to solve cases in everyday life (Anggraena et al., 2022). This is a new collaboration on the basic laws of chemistry. The reason is, in the previous curriculum, namely Curriculum 2013, the basic laws of chemistry were juxtaposed with the concept of moles or stoichiometry because they are both the basis for learning chemical calculations.

If you study chemical reaction equations and the basic laws of chemistry first, then students will be confused because they are not familiar with atomic symbols, compound masses, substance forms, and compound names which are prerequisite materials for the law of conservation of mass in the basic laws of chemistry based on royal society chemistry. In the previous chapter on 'Green Chemistry in Sustainable development 2030' there was a mention of writing chemical reactions at the end of the chapter. Meanwhile, the next chapter only explains the characteristics, types and ways of writing chemical reactions. This will certainly create misconceptions in students and educators are also confused in providing material.

Therefore, this research recommends ATP and material hierarchy so that educators can provide structured learning. The recommended ATP and hierarchy are the result of looking at the breadth and depth of material in standard textbooks and the material boundaries using science books published by the Ministry of Education and Culture which are presented in the form of a macro structure. Macro structure is a text representation model that looks at the relationship between concepts and their main provisions and micro provisions. Furthermore, daily learning objectives are obtained which will lead to more detailed learning activities.

Macro-structure is a model of text representation that looks at the relationship between concepts and main propositions and their micro-propositions. Text representation is the interaction of syntactic aspects and substantial aspects, which are expressed by propositions and connected by lines of progression from top to bottom, while lines of elaboration from right to left that set the structure of macro organization or micro organization. The important

things that must be considered in making the macro structure are "...propositions as the basic unit of information and application of arguments" Van Dijk and Kintsch mention propositions as units of discourse in charge of constructing knowledge. "Propositions are the basic unit of information in the human information processing system. Propositions can be equated with ideas" (Biber et al., 1986).

The sequence of chemistry materials recommended for Phase E chemistry ATP is to explain the phenomenon of scientific work rules in explaining chemical concepts in everyday life, atomic structure and its application in nanotechnology, chemical reactions, basic laws of chemistry, chemical concepts in environmental management, and the phenomenon of global warming. These results are obtained after analyzing the scope of material in the three learning outcomes, content standards in Permendikbud number 7 of 2022, learning objectives that have been formulated, and the scope of material in standard textbooks by Brady 7th edition. Next is the presentation of the material hierarchy in the form of a macro structure.

Table 2. Macro structure position of basic laws of chemistry material

Main Prosition	Micro Prosition 1	Micro Prosition 2	Micro Prosition 3	Micro Prosition 4
Basic Law of Chemistry	Avogadro's number and number of moles	Number of particles		
	Basic law of chemistry	Law of conservation mass	Molar Massa	Relative atomic mass (Ar)
				Relative molecular mass (Mr)
		Law of definite proportion		
		Law of multiple proportion		
	Gas Laws	Law of combining volume		
		Avogadro's hypothesis		

CONCLUSION

Based on the results of the analysis that has been carried out, it can be concluded that in one regulation that regulates learning outcomes (CP), namely BSKAP 033 in 2022, it contains three different CP texts, namely CP of chemistry learning, CP per phase consisting of Phase E and Phase F, and CP per element consisting of chemical understanding elements and process skills elements. The material content and skill aspects are found in all three CPs, but the attitude aspect is only found in CP Phase E. Meanwhile, the general character and competencies to be developed are stated in the Profil Pelajar Pancasila separately. For the analysis of the reduction of CP to TP, an alternative based on cross CP elements is used because both elements will participate in one TP. Material hierarchy analysis needs reference from the scope of learning outcomes material and content standards so that there is no overlap between materials.

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