



Analysis of Critical and Creative Thinking Aspects in The Science Textbook of Merdeka Curriculum Materials of Measurement in Scientific Work

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Abstract: This study aimed to identify the elements of critical and creative thinking in the Measuring Merdeka High School Curriculum in Science textbooks. This research uses a qualitative descriptive research type. The data source was the Science textbook for SMA Class X Merdeka Curriculum. The instrument used in this research is the researcher as the main instrument. This research's supporting agents are data collection and analysis guides. The data collection procedure in this study was to use documentation techniques. This study's stages of data analysis include data reduction, data presentation, and conclusion. The results showed that the Merdeka High School Curriculum Science textbook on Measurement in Scientific Work contains four elements of critical thinking and seven elements of creative thinking. This research implies that future results of this study can be used as reference material and references in further research.

Abstrak: Tujuan penelitian ini adalah mengidentifikasi unsur-unsur berpikir kritis dan kreatif dalam Kurikulum SMA Merdeka Pengukuran dalam buku ajar IPA Karya Ilmiah. Penelitian ini menggunakan jenis penelitian deskriptif kualitatif. Sumber data yang digunakan adalah buku teks IPA SMA Kelas X Kurikulum Merdeka. Instrumen yang digunakan dalam penelitian ini adalah peneliti sebagai instrumen utama. Instrumen pendukung dalam penelitian ini adalah panduan pengumpulan data dan panduan analisis data. Prosedur pengumpulan data dalam penelitian ini adalah menggunakan teknik dokumentasi. Dalam penelitian ini tahapan analisis data meliputi reduksi data, penyajian data, dan penarikan kesimpulan. Hasil penelitian menunjukkan bahwa buku ajar IPA Kurikulum SMA Merdeka pada materi Pengukuran dalam Kerja Ilmiah mengandung empat unsur berpikir kritis dan tujuh unsur berpikir kreatif. Implikasi dari penelitian ini adalah diharapkan ke depannya hasil penelitian ini dapat dijadikan sebagai bahan referensi dan rujukan dalam penelitian selanjutnya.

A. Introduction

Learning in the merdeka curriculum cannot be separated from learning tools, namely textbooks. Textbooks are one of the primary sources of learning, especially in physics lessons (Sandi et al., 2013; Permatasari & Anwas, 2019). Textbooks are primary sources of education that contain knowledge, skills, and aspects of attitude (Rohmawan, 2020; Susanti, 2013). The preparation and writing of textbooks must meet the rules of national regulations and the applicable curriculum (Cicilia & Retnani, 2016; Malabar et al., 2013).

Ernawati (2019) states that the formation of textbooks must be aligned with the national curriculum and a curriculum suitable for the situation, environmental demands, and the features of the academic unit in question. Therefore, physics textbooks must comply with the requests of the Merdeka curriculum that focuses on 21st-century learning that includes critical and creative thinking skills. Thus, the prepared books must provide a stimulus for students to get used to thinking critically and creatively (Sriliani et al., 2022; Suryaman, 2015).

The quality of education and the students in a nation are influenced by their capacity for critical and creative thinking (Ekawati et al., 2018; Maya et al., 2018; Rachmantika & Wardono, 2019). PISA, as a world academic assessment program, has surveyed students' level of education and quality in countries around the world (Sari & Yulisetiani, 2022). The results of the PISA (International Student Assessment Program) survey announced by the OECD (Organization for Economic Cooperation and Development) in 2016 placed Indonesia at the bottom of the 72 countries surveyed. This can be used to evaluate education in Indonesia so that it changes in a better direction. These changes can be achieved if the learning process prioritizes higher thinking. This is because the habit of high-level thinking (critical and creative) in learning is beneficial for successfully developing students' thinking skills.

Critical thinking is the ability to think that puts forward an in-depth analysis of a problem (Azrai et al., 2020; Santosa et al., 2018; Nadeak et al., 2020; Nugraheni et al., 2013; Nashrullah et al., 2021). The idea of critical thinking proposed by Facione is one of the principles of critical thinking that serves as a guide in this study—considering that the definition of essential skills of thinking offered by Facione in 2016 is consistent with the qualities of high-level thinking. Facione breaks down the various components of critical thinking into inference, explanation, evaluation, self-regulation, interpretation, and analysis (Lestari, 2022). The division of the six elements into categories in critical thinking is an attempt to understand the level of crucial thinking to readers and provides a transparent barrier between necessary thinking skills and other thinking abilities.

Creative thinking is higher than critical thinking (Ananda et al., 2021; Fitriyah & Ramadani, 2021; Sari & Putra, 2015; Siswono, 2016). Creative thinking prioritizes the issuance of new ideas and ideas (Rohmah et al., 2022). One of the concepts of creative thinking was put forward by Davide Folletto Casali in 2017. Casali divides creative thinking into fourteen elements that have their characteristics. Casali emphasized that the fourteen

elements of creative thinking are efforts to create, analyze, and improve creative processes for individuals, cultures, and groups.

Previous studies have analyzed many aspects of critical and creative thinking in textbooks, but no one has investigated the elements of critical thinking and creative thinking in merdeka curriculum textbooks because only a few schools have implemented this curriculum. One of the studies that analyze aspects of critical thinking and creative thinking in books is research conducted by Rohmawan (2020). The results showed six elements of critical thinking and eleven aspects of creative thinking in the textbooks used by students in the 2015 Study Program of Language Education, Indonesian Literature, and the Regions of the Faculty of Letters at the State University of Malang.

According to this explanation, this study aimed to examine the Merdeka Curriculum science textbooks, measuring material in scientific work activities with critical and creative thinking aspects.

B. Method

This type of research is a type of qualitative research. This study will describe thoroughly and objectively, based on the data collected, the data analysis used to conclude the analysis of critical and creative thinking aspects in the Merdeka Curriculum on measurement in the SMA Science textbook of the Merdeka Curriculum on size in scientific work. The design of this study uses content analysis research methods. Krippendorff (2004) states that content analysis is a research technique for making reproducible and valid inferences from data based on the context of its use. Data is required in research as the raw material for concluding data analysis. The content analysis design flow, according to Krippendorff, can be stated in Figure 1.

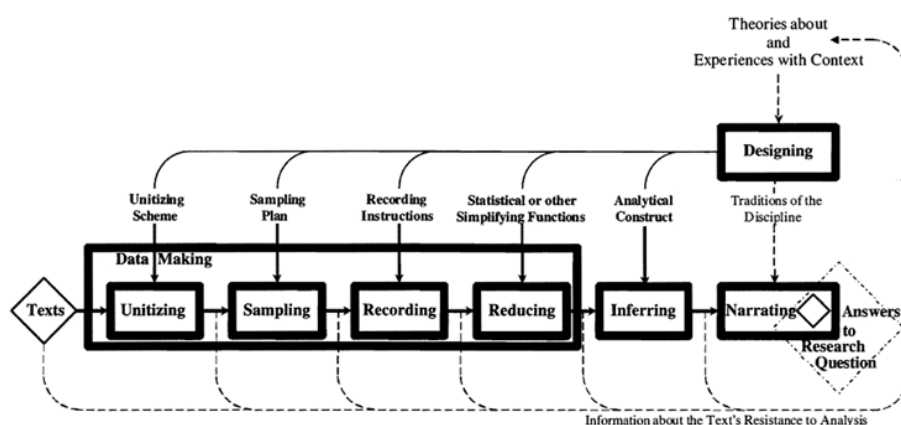


Figure 1. Content analysis design flow (Krippendorff, 2004)

The instrument used in this research is the researcher as the main instrument. Sukardi (2013) states that in qualitative research, researchers directly explore, identify, explain, and predict the symptoms that occur from the data in the field. This research's supporting instruments are data collection and analysis guides.

The data collection procedure in this study was to use documentation techniques. Data collection documentation against data sources, namely science textbooks at Merdeka Curriculum SMA, provides material for measurement in scientific work activities. The data analysis in this study used a qualitative approach. The stages of data analysis in this study are (1) data reduction, (2) data presentation, and (3) conclusion.

C. Result and Discussion

Aspects of Critical Thinking in the Merdeka Curriculum Science Textbook on Measurement Materials in Scientific Work Activities

Several aspects of critical thinking have been found in the Merdeka Curriculum Merdeka High School Science textbook on Measurement in Scientific Work Activities. These aspects are interpretation, analysis, evaluation, and inference.

1. Interpretation Aspects

First is the aspect of interpretation. [Facione](#) (1990) states that interpretation is an activity to express oneself from various experiences, situations, data, events, or information received. The aspect of interpretation found in textbooks is in the form of activities to express opinions from various experiences, situations, data, events, or information that has been received. The writer's findings show that several words used in textbooks are included in the aspect of interpretation. These words are found in questions and commands in books. The comments are in the form of activities to express oneself from various experiences, situations, data, events, or information that has been received. The words used to express oneself from experience in textbooks include:

- (1) *"Jelaskan pendapatmu, mengapa harus ada kedua alat ukur yang berbeda untuk besaran yang sama?"*
- (2) *"Menurut pendapat Kalian, apakah hasil pengukurannya akan sama atau berbeda? Jelaskanlah alasannya."*
- (3) *"Berdasarkan hasil perbandingan hasil pengukuran yang Kalian dapatkan, alat ukur apa yang cocok dan tidak cocok untuk mengukur diameter baut? Seberapa teliti pengukurannya? Jelaskan alasannya."*
- (4) *"Berdasarkan pengamatan Kalian pada baut, Besaran turunan fisika apa yang dapat digunakan untuk mengetahui jenis baut?"*
- (5) *"Setelah Kalian mempelajari bab pengukuran. Peranan, manfaat, atau pembelajaran apa yang dapat diambil? Tuliskan pada buku latihan Kalian."*

2. Analysis Aspects

Second is the aspect of analysis. [Facione](#) (1990) states that analysis is an activity in critical thinking to identify a statement, question, concept, description, information, or other forms of representation in depth. The aspect of the analysis found in textbooks is identifying in-depth activities from a statement, concept, description, and information.

The writer's findings show that several words used in textbooks are included in the analysis aspect. These words are in the order in the textbook. The comments are in the form

of activities to identify a statement, concept, description, and information in depth. The words used to place a message in a textbook include:

- (6) *"Carilah informasi mengenai apa saja yang dapat dikatakan sebagai angka penting dan yang bukan angka penting, beserta contohnya."*
- (7) *"Cobalah untuk mencari contoh bagaimana perkalian dan pembagian angka penting, serta penjumlahan dan pengurangan angka penting dioperasikan dalam proses pengolahan data."*
- (8) *"Jika nilai yang Kalian dapatkan dari hasil pengolahan data sangat kecil atau sangat besar, bagaimana cara Kalian menuliskannya?"*
- (9) *"Carilah informasi mengenai faktor-faktor apa saja yang menyebabkan kesalahan pengukuran"*
- (10) *"Bandingkan dengan nilai massa jenis hasil pengolahan data yang Kalian dapatkan. Apakah nilai massa jenis hasil pengolahan data sama atau mendekati atau berbeda jauh dengan nilai massa jenis yang Kalian cari pada tabel? Jelaskan mengapa demikian?"*

3. Evaluation Aspects

The third is the evaluation aspect. [Facione](#) (2016) states that evaluation is an activity to assess the credibility of statements, whether in the form of information, experiences, ideas, situations, values, beliefs, or opinions. Evaluation aspects found in textbooks are activities to assess knowledge, views, conditions, deals, and statements.

The writer's findings show that several words used in textbooks are included in the evaluation aspect. These words are in the order in the textbook. The comments are in the form of activities to assess information, ideas, situations, values, and opinions. Terms used to evaluate knowledge in textbooks include:

- (11) *"Tuliskanlah hasil pengukuran mikrometer sekrup sesuai dengan aturan cara penulisan hasil pengukuran di atas."*
- (12) *"Berdasarkan aktivitas yang dilakukan, adakah besaran yang diukur dengan alat ukur yang tidak sesuai? Besaran apa saja yang diukur dengan alat ukur yang tidak sesuai? Jelaskan mengapa alat ukurnya tidak sesuai?"*
- (13) *"Jika ketiga jenis baut berbeda, tentukanlah variabel bebas, variabel terikat, dan variabel kontrol dalam praktikum ini."*

4. Inference Aspects

Fourth is the aspect of inference. [Facione](#) (2016) states that drawing reasonable conclusions from facts, assertions, guiding theories, evidence, judgments, views, opinions, concepts, descriptions, information, or other types of representation is the process of inference. The aspect of belief found in textbooks is concluding ideas and information.

The writer's findings show that several words used in textbooks are included in the inference aspect. These words are in the order in the textbook. The comments are in the form of activities to conclude concepts and information. The terms used to complete an idea in textbooks include:

- (14) *"Berdasarkan kegiatan yang dilakukan, buatlah kesimpulan yang kalian dapatkan."*
- (15) *"Buatlah kesimpulan hasil percobaan yang Kalian peroleh lalu komunikasikan dalam kelas."*

(16) “....Apa yang dapat Kalian simpulkan?”

Aspects of Creative Thinking in the Merdeka Curriculum Science Textbook on Measurement Materials in Scientific Work Activities

Several aspects of creative thinking have been found in the Merdeka Curriculum Merdeka High School Science textbook on Measurement in Scientific Work Activities. These aspects generate results, independence and freedom, innovation and emotional involvement, social interaction and communication, and values.

1. Generating Results Aspects

First, the aspect generates results. Casali (2017) states that generating results is related to solving a problem or problem that focuses on discovering different and unique concepts, ideas, or ways. Developing results found in textbooks is in the form of activities to solve a problem or problem that focuses on a different and unique way.

The writer's findings show that several words in the textbook are included in the aspect of generating results. These words are found in the instructions in the book. The comments include activities to solve a problem or problem that focuses on a different and unique way. Words used to solve a problem or problem that focuses differently and uniquely in textbooks, among others:

- (1) “Bagaimana cara memastikan ukuran baut sudah sesuai dengan murnya?”
- (2) “Bagaimana cara memastikan bahan material mur dan baut sudah benar?”
- (3) The questions that arise are based on the problems given in the discourse text in the "Ayo Cek Pemahaman" section on page 23.



Jawablah pertanyaan berikut ini.

Bacaan untuk pengerjaan soal nomor 1 sampai dengan 5.

Bacalah cuplikan berita berikut ini.

TEMPO.CO, Bangkalan. Petugas Dinas Perindustrian dan Perdagangan Jawa Timur menggelar tera ulang timbangan di kantor Kecamatan Kamal, Kabupaten Bangkalan, Jawa Timur, Selasa, 3 November 2015. Puluhan pedagang di Pasar Kamal dan pemilik toko kelontong datang membawa timbangan mereka untuk diservis.

“Mayoritas timbangan yang dibawa tidak sesuai dengan standar nasional,” kata Dary, petugas tera dari Unit Pelaksana Tugas Bidang Kemetrolgian Pamekasan Dinas Perindustrian dan Perdagangan Jawa Timur.

Menurut dia, ada banyak hal yang menyebabkan timbangan pedagang tidak sesuai dengan standar nasional, di antaranya cara pemakaian yang tidak tepat dan lain-lain. Tentu ada juga yang sengaja diakali. “Tapi mayoritas yang dibawa ke sini karena faktor alam, yaitu karatan, sehingga keseimbangan berubah melewati batas toleransi selisih sebesar 20 gram untuk timbangan 5 kilogram,” ujarnya.



Sementara itu, Komarudin, salah satu petugas tera, menyebut ciri-ciri timbangan yang diakali pedagang. Menurut dia, bila pedagang buah atau pedagang sembako selalu meletakkan batu kiloan di atas timbangan, patut dicurigai timbangan tersebut telah diakali.

Sementara itu, Sukron, pedagang di Pasar Kamal, meminta tera ulang tidak dilakukan sekali dalam satu tahun. Sebab, kerusakan timbangan selalu membuat dia tekor. “Kalau bisa, ada petugas tera di tiap kecamatan. Jadi, kapan pun rusak, timbangan bisa langsung diperbaiki,” ucapnya. Soal biaya tera, Sukron mengatakan tidak mahal. Untuk timbangan 5 kilogram hanya dikenai biaya Rp6.500 per unit.

Sumber: <https://nasional.tempo.co/read/715491/inilah-cara-mengenal-timbangan-yang-dicurangi-pedagang>

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: _____

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

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

Alasan: _____

3. Pada paragraf ketiga, kalimat ketiga disebutkan bahwa kesalahan akibat faktor karatan menyebabkan keseimbangan berubah melewati batas toleransi selisih sebesar 20 gram untuk timbangan 5 kilogram, artinya persentase ketidakpastian relatifnya adalah...

- ☐ 0,25%
- ☐ 0,40%
- ☐ 2,50%
- ☐ 4,00%

Cara pengerjaan: _____

Figure 2. Activity “Ayo Cek Pemahaman”

2. Independence and Freedom Aspects

Second, the aspect of independence and freedom. Casali (2017) states that the elements of autonomy and freedom are in the form of activities that encourage creativity by providing the flexibility to develop concepts, ideas, or ways by each other's thoughts, knowledge, and experiences. The aspects of independence and freedom found in textbooks are activities to develop concepts and ideas.

The findings of the authors indicate that there are several words contained in textbooks which include aspects of independence and freedom. These words are in the order in the textbook. The words are in the form of activities to develop concepts and ideas. The words used to develop concepts in textbooks include:

- (4) *"Buatlah grafik hubungan massa garam dapur (X) dan kenaikan suhu larutan garam (Y). Grafik dapat dibuat menggunakan kertas milimeter graph atau menggunakan program komputer"*
- (5) *"Buatlah kesimpulan hasil percobaan yang Kalian peroleh lalu komunikasikan dalam kelas."*
- (6) *"Setelah Kalian mengamati Gambar 1.4, buatlah dan isilah tabel pada buku latihan Kalian seperti tabel berikut ini"*

3. Innovation and Emotional Involvement Aspects

Third, aspects of innovation and emotional involvement. Casali (2017) states that parts of the invention and emotional involvement can be assumed to regulate and manage emotions through stimuli that evoke reactions, solutions, or innovations to a problem presented. The aspects of innovation and emotional involvement found in textbooks are activities to bring innovation to a problem shown.

The writer's findings show that several words in the textbook are included in the aspects of innovation and emotional involvement. These words are found in questions in textbooks. The words are in the form of activities to bring about innovation. The words used to bring out the innovation in the textbook are *"Dengan mempertimbangkan wujud baut tersebut, alat ukur apa yang dapat digunakan untuk mengukur besaran-besaran yang disebutkan pada nomor 2? Jelaskan bagaimana Kalian mengukurnya?"*

4. Social Interaction and Communication Aspects

Fourth, aspects of social interaction and communication. Casali (2017) states that parts of social interaction and communication are related to fostering communication, interaction, and social sensitivity. The aspects of social interaction and communication found in textbooks are activities to encourage social interaction.

The writer's findings show that several words in the textbook are included in the aspects of social interaction and communication. These words are in the order in the textbook. The comments are in the form of activities to foster social interaction. The words used to foster social interaction in textbooks are *"Tuliskanlah pada buku latihan dan tanyakanlah pada guru pertanyaan lainnya yang timbul pada benak Kalian?"*

5. Values Aspects

Fifth is the value aspect. Casali (2017) states that the value aspect is in the form of activities that reveal life values or messages in a presentation. The values expressed are related to everyday life (mandates) that cause positive behavioral effects. Aspects of matter found in textbooks are activities to reveal messages, messages, and lessons that have positive value.

The writer's findings show that several words are contained in textbooks that are included in the value aspect. These words are found in questions in textbooks. The comments are in the form of activities to reveal messages, messages, and positive value lessons. The terms used to express the message and message in the textbook are *"Setelah Kalian mempelajari bab pengukuran. Peranan, manfaat, atau pembelajaran apa yang dapat diambil? Tuliskan pada buku latihan Kalian."*

Discussion

Analysis of Aspects of Critical and Creative Thinking in the Merdeka Curriculum Merdeka High School Science Textbook aims to determine the components of critical thinking and creative thinking in textbooks. These two components are the abilities that the independent curriculum wants to aim at. The first analysis carried out in this study was selecting the books to be analyzed. The texts analyzed were science textbooks for Class X SMA Merdeka Curriculum, used by students in the learning process.

Data collection will be collected using documentation techniques to see the components of critical and creative thinking. Then an analysis of the two aspects of the book is carried out. The first aspect to be analyzed in the textbook is the aspect of critical thinking. The book's analysis is adapted to the concept of critical thinking put forward by Facione. So that the result is that the textbook contains the expected aspects of critical thinking, which include the four elements of critical thinking, interpretation, analysis, evaluation, and inference. The application of critical thinking is expected that students can analyze and solve a problem, therefore students must read a lot to gain knowledge (Haeruman et al., 2017; Marfu'i, 2016; Nurmaharani et al., 2017; Oka, 2010)

The second aspect being analyzed is the aspect of creative thinking. Creative thinking skills can link students and their environment (Budiman & Fathima'ruf, 2020). Based on the analysis conducted, the Merdeka Curriculum SMA Science textbook on Measurement in Scientific Work Activities Materials contains seven elements of creative thinking: generating results; independence and freedom; innovation and emotional involvement; social interaction and communication; and values. The application of creative thinking in textbooks aims at showing students how to do things in a way that is different from the previous method, not in a way that is just like that so that they can compete in the conditions of the world that are developing at this time (Marlina & Jayanti, 2019; Sugiyarti et al., 2018; Yusliani et al., 2019)

D. Conclusion

Based on the analysis that has been done, four aspects of critical thinking are found in the science textbook at SMA Merdeka Curriculum Material: Measurement in Scientific Work. The four elements of critical thinking found are (1) interpretation, (2) analysis, (3) evaluation, and (4) inference. These four aspects are seen in commands and questions in textbooks. Critical thinking characteristics found in books are expressing opinions, identifying activities, evaluating activities, drawing conclusions, re-explaining, and correcting movements.

Based on the analysis conducted, five aspects of creative thinking were found in the science textbook Merdeka Curriculum SMA on Measurement in Scientific Work. The five elements of creative thinking found are (1) generating results; (2) independence and freedom; (3) innovation and emotional involvement; (4) social interaction and communication; and (5) values. These five aspects are found in textbooks' sentences, questions, and commands. Elements of creative thinking found in books include activities to increase student activity by providing motivation; problem-solving activities in different and unique ways; exercises to develop concepts and ideas; workouts to generate innovation; activities to create and produce creative work; activities to repeat actions learned; activities to foster social interaction; and movements to reveal messages and lessons of positive value.

Suggestions for further researchers, namely, this research can be used as reference material and references in further research because research on critical thinking and creative thinking is needed to provide book authors with the ability to produce quality work.

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