Development of Contextual-Based Mathematics and IPAS Textbooks for Elementary School Phase A in Support of Independent Learning

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ABSTRAK	ABSTRACT
Guru sering mengalami kesulitan menciptakan aktivitas belajar yang menyenangkan dan relevan dengan kehidupan sehari-hari siswa, sehingga pembelajaran menjadi kurang bermakna. Penggunaan buku ajar sangat mempengaruhi cara guru mengajar dan pemahaman siswa, terutama di tingkat rendah Sekolah Dasar (kelas 1 dan 2) sesuai dengan Fase A Kurikulum Merdeka. Mata pelajaran seperti matematika dan IPAS banyak materi yang bisa dieksplorasi dengan aktivitas menarik agar siswa lebih menikmati dan memahami pembelajaran. Saat ini, Indonesia menggunakan Kurikulum Merdeka yang menuntut guru memberikan pembelajaran berbasis proyek dan sesuai konteks. Oleh karena itu, pada penelitian ini tertarik mengembangkan buku ajar yang bisa digunakan guru SD sebagai pedoman mengajar. Buku ajar ini diharapkan dapat membantu mahasiswa calon guru dalam mempersiapkan diri saat program pengalaman lapangan atau pembelajaran mikro pada mata kuliah PSAP. Metode penelitian yang digunakan adalah Research and Development (R&D) dengan model 4-D. Hasil penelitian menunjukkan bahwa buku yang disusun layak digunakan dengan hasil validasi 88,19 % dengan beberapa revisi agar lebih mudah dibaca dan membantu guru dalam mengajar secara integratif. Buku ajar yang disusun juga memiliki keunikan, diantaranya terdapat integrasi antara matematika dengan IPAS. Harapannya buku yang telah disusun dapat memberikan manfaat bagi pembaca khususnya dalam mengajar materi matematika dan IPA pada sekolah dasar. **Kata Kunci**: Buku Ajar; Pembelajaran Kontekstual; Matematika; IPAS; SD Fase A	Teachers often face difficulties in creating enjoyable and relevant learning activities that connect to students' daily lives, making the learning experience less meaningful. Textbooks significantly impact how teachers teach and students learn, especially at the lower elementary level (grades 1 and 2), as per Phase A of the Merdeka Curriculum. Subjects like mathematics and IPAS have a wealth of material that can be explored through engaging activities, helping students enjoy and understand the learning process. Indonesia uses the Merdeka Curriculum, which requires teachers to provide project-based and contextually appropriate learning. Therefore, this research aims to develop a textbook that elementary school teachers can use as a teaching guide. This textbook is also expected to assist prospective teacher students in preparing field experience programs or microteaching in the PSAP course. The research method used is Research and Development (R&D) with a 4-D model. The research results indicate that the developed textbook is suitable for use, with some revisions to make it easier to read, and to help teachers provide integrative teaching, achieving 88.19% validity. The textbooks that are prepared also have uniqueness, including the integration between mathematics and IPAS. It is hoped that the developed textbook will benefit readers, particularly in teaching mathematics and science in elementary schools. **Keywords**: Textbook; Contextual Learning; Mathematics; IPAS; Elementary School Phase A

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1. INTRODUCTION

Education is an important pillar in life and the foundation of an information framework (Rusmayadi & Herman, 2019). Education is an effort in the form of guidance provided by someone capable of helping others to develop their personal lives so that they can acquire sufficient skills to live and have an impact on their surrounding environment (Husamah et al., 2019). The purpose of education is to develop the physical, mental, emotional, social, moral, and spiritual aspects of life. Education is the key to navigating the world and helps individuals secure better employment (Idris et al., 2012). Through education, humans learn to take responsibility for developing the potential God has given them so that they can manage God's creation effectively. Formally, education is carried out through schools where teachers guide and lead students to understand concepts, develop skills, and unlock their potential. The quality of education is primarily determined by the character of a teacher who guides and motivates students (Huda, 2017; Illahi, 2020). In addition to having a calling, a teacher needs to be equipped to develop their competencies so that they can provide students with meaningful learning experiences. Similarly, the definition of a teacher involves significant responsibilities, namely introducing God's creation and, through teaching, serving God (Sembiring & Listiani, 2023; Zega & Tarigan, 2024).

Meaningful learning is defined as learning that yields benefits to students (Bradley et al., 2023; Ligabo et al., 2023; Woda et al., 2022, 2023). Through meaningful learning, students at any level can understand the concepts taught and apply them in their daily lives. In addition, students are also given space to practice skills by their developmental stages, so that they can ultimately take responsibility for utilising their potential. When meaningful learning occurs in the classroom, students can be involved and participate actively. They have the desire and passion to learn, and they can understand the importance of the knowledge being learned, allowing learning to have a personal impact on their lives and the class as a whole. The transition from the 2013 Curriculum to the Merdeka Curriculum aims to enable students to experience meaningful learning in the classroom, thereby allowing children of the nation to enjoy the freedom of learning. Freedom to learn means that every student has the space to learn according to their individual needs, to explore out of an intense curiosity about everything around them rather than out of compulsion, and to be able to share their opinions and express themselves authentically about their daily experiences (Bastari, 2021; Malehere & Listiani, 2024). Meaningful learning offers a new perspective that learning is something important and should be pursued throughout one's life, not merely for the sake of getting good grades, passing exams, or securing a decent job, but to develop each holistically so that every person can make a positive impact on their surroundings wherever they may be.

One learning model that can enable students to gain meaningful learning is contextual and enjoyable learning (Ausubel, 1968), as stated by David Ausubel, who posits that learning will

be meaningful if new information is linked to concepts relevant to cognitive structure (Wahyuni & Ariyani, 2020). Contextual learning is an educational activity that connects learning materials to everyday life (Andri, 2018; Damayanti & Afriansyah, 2018; Anggraini, 2017; Kurinta et al., 2021; Muhartini et al., 2023). Ideally, context-based learning can be meaningful because students are taught to understand the concepts of the material by contexts relevant to their development, including their surrounding environment. Based on research findings, there are differences in science learning outcomes between students who participate in contextual learning and those who participate in traditional, or conventional, learning. Students have higher learning motivation when learning using contextual learning (Primayana et al., 2019). Learning that can be connected to real life indeed becomes a learning experience that can motivate students to think, explore, and discover its meaning. Additionally, the essence of independent learning is that teachers gain the freedom to explore and create meaningful learning experiences (Daga, 2021).

Contextual learning for elementary school students differs significantly from that for middle school or high school students. Elementary school students are divided into two groups: lower-grade students and upper-grade students. Lower-grade students, particularly those in Phase A, are students in grades 1 and 2 of elementary school, aged between 6 and 8 years old. At this stage, students require ample stimulation to facilitate holistic development, particularly in terms of social skills (social-help skills) and motor skills. Lower-grade teachers must design learning activities that align with the context of children who still struggle with sustained attention. Lower-grade students heavily rely on concrete examples to understand concepts, as they are still in the concrete operational stage of development. At this stage, students also view learning as a unified and integrated whole, so teachers need to integrate all learning activities in a cohesive manner rather than in a fragmented way (Zulvira et al., 2023).

The urgency of this research was raised because there are still facts that elementary school teachers are not yet optimal in providing meaningful learning for elementary school students. Several realities were found in schools that the creativity expressed by teachers in teaching is still dominated by methods that seem traditional or follow old ways. Teachers are still fixated on teaching using a single method, such as lectures, resulting in one-way learning (Trisnayanti, 2017). Additionally, many teachers still conduct lessons without the aid of learning media or use inadequate media, making it difficult for students to understand the concepts being taught (Yuangga & Sunarsih, 2020). According to Mutmainah et al. (2023), learning that lacks the use of learning media can lead to boredom and monotony among students. An initial survey of 10 elementary schools revealed that 70% of teachers struggle to integrate Mathematics-IPAS. The difficulties faced by teachers include a lack of integrated teaching materials, a limited understanding of cross-disciplinary concepts, and inadequate training on integrative approaches. This highlights a gap between curriculum requirements and teachers' readiness in the field,

necessitating a learning model or teaching materials that can facilitate such integration in a practical and applicable manner. Therefore, there is a strong need for learning media that can equip teachers to deliver meaningful learning experiences for elementary school students in Phase A.

The learning media developed in this study are context-based mathematics and science textbooks for lower elementary school students. One of the research findings states that the research product, a textbook with a contextual approach that can promote creative thinking skills in elementary school students, requires further development for various subjects (Sabri et al., 2023). At one elementary school in Lubuklinggau, a phenomenon exists where teachers and students lack textbooks that are relevant to students' daily lives, which negatively impacts students' motivation to learn and their science learning outcomes. This is certainly very unfortunate because science and mathematics are important subjects that should be taught from an early age to encourage children to think critically and creatively and to help them understand themselves and their surroundings better.

The concepts taught in mathematics and science may seem abstract to children. However, they are closely related to children's daily lives and are valuable for children, depending on their age levels. The Mathematics and Science textbooks developed not only contain theory but also include concepts relevant to the students' world, a variety of concrete activities that teachers can conduct with students and that students can follow according to the topics taught, as well as various examples of teaching aids that teachers and students can use in the classroom. Context-based Mathematics and Science textbooks for the elementary school phase A are essential for prospective elementary school teachers at the Faculty of Education. In one of the courses, namely PSAP Mathematics and Science/Social Studies for Elementary School, each prospective elementary school teacher is trained to teach Mathematics and Science/social studies to lower elementary school grades. The developed textbooks can serve as a reference material for prospective teachers in designing lessons and conducting microteaching activities in a contextual setting. The developed textbooks will serve as a guide for elementary school teachers in delivering contextual Mathematics and Science/Social Studies lessons, making them meaningful for students. Therefore, the purpose of this research is to develop context-based Mathematics and Science/Social Studies textbooks for lower elementary school grades to support independent learning.

2. METHOD

The research method used in developing this phase A elementary school mathematics and science textbook was R&D development research using the 4-D model, namely the define stage, the design stage, the development stage, and the disseminate stage (Maydiantoro, 2021;

Riani Johan et al., 2023; Widiyasari et al., 2020). The procedure for developing context-based Mathematics and Science learning modules is as follows (Thiagarajan et al., 1974):

1. The define stage

At this stage, researchers conducted an analysis of mathematics and science materials for lower elementary school grades, an assessment of the needs of lower elementary school teachers, and an evaluation of the independent curriculum. At this stage, questionnaires were distributed to lower elementary school teachers, and a focus group discussion (FGD) was held, attended by seven individuals, including a team of experts in mathematics and science education for elementary schools.

2. The design stage

This section involves the design of a product in the form of a mathematics and science textbook for elementary school phase A based on a contextual approach, starting with mapping the learning outcomes of mathematics and science for elementary school phase A, connecting the learning outcomes of mathematics and science so that they can be integrated, and grouping the learning outcomes into four chapters arranged in the textbook. At this stage, validity instruments for the resulting textbooks are also developed and validated by experts.

3. The development stage

This section involves further development of the textbook, specifically by filling in the content and contextual learning activities or exercises in each chapter that have been compiled, and adding interesting and relevant images suitable for the elementary school level.

4. The disseminate stage

This section validates the textbooks that have been developed. There are three validators from the fields of mathematics, science, and social studies who test the validity of the textbooks to see if they achieve their objectives. After the validation process, the researchers revise the content and design of the textbooks. After that, the textbooks are printed and reproduced according to their intended use.

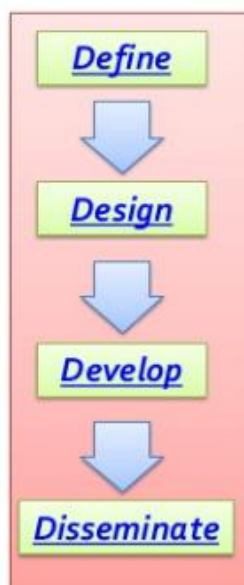The following Figure 1 is the flowchart of the 4-D model:

Figure 1. 4-D Model Flowchart

In the define stage, researchers distributed questionnaires to elementary school teachers in phase A (lower grades) to explore the needs and challenges in integrated Mathematics and IPAS learning. Forty-eight respondents assessed the suitability of the textbooks, and the FGD involved 7 participants, comprising lecturers specialising in Mathematics and Science education, as well as experienced teachers who were competent in implementing the Merdeka Curriculum in lower grades.

To assess the suitability of textbooks, a validation sheet was compiled based on four aspects: content, language, presentation, and illustrations. Experts first validated the instrument before being used. The instrument consisted of a rating scale using a range of $1 - 4$. The following is an attachment of the instrument used for validation (see Appendix 1).

The validation data were analysed using quantitative descriptive statistics, namely by calculating the percentage of suitability for each aspect using the formula:

$$P = \frac{x}{x_i} \times 100\%$$

P = Percentage of each criterion

x = Score of each criterion

x_i = Maximum score of each criterion

Next, the percentage results were categorised based on the assessment scale from the Centre for Books and Curriculum (2008). Data processing was carried out using Microsoft Excel to present scores, percentages, and average feasibility per aspect. Qualitative data from validator suggestions were analysed descriptively and thematically to compile revisions and further develop the textbook.

3.   RESULT AND DISCUSSION

Textbooks are an essential component that teachers must utilise in the learning process (Aisyah et al., 2020; Magdalena et al., 2020). Currently, numerous textbooks have been compiled by authors for elementary school learning. However, there are still a few books that directly combine mathematics material with IPAS material. IPAS is a new subject in the independent curriculum in Indonesia (Fadhilah & Rifayanti, 2024). The textbook has been compiled using a contextual learning approach and adheres to the Ministry of Education and Culture's guidelines for textbook development (Ministry of National Education, 2018). Contextual learning refers to learning conducted in the classroom that utilises contexts related to daily life (Elgort et al., 2015; Surapaneni, 2024). The advantage of the textbook developed is that teachers can simultaneously teach IPAS material and mathematics. The textbook development model used is the 4D model.

During the definition stage, learning objectives were analyzed by the Merdeka Curriculum, which is currently being implemented in Indonesia. The analysis of learning objectives yielded four major topics that will be utilized in designing textbooks. The four topics are My Perfect Body, Miracles in My Home, Adventures Outside My Home, and My Amazing Earth. From these four main topics, the materials to be covered in the IPAS subject and mathematics are mapped out. The four main topics are broken down into several learning outcomes developed by synchronising IPAS learning with mathematics learning. Teachers can teach science materials while also teaching mathematics simultaneously.

During the design stage, textbooks were developed based on learning outcomes. The textbook is created using the Canva application, which leverages artificial intelligence and illustrations available in Canva Premium. Learning through illustrations or visual media offers significant benefits for elementary school students, including fostering a love for reading, developing imagination, stimulating curiosity, enhancing learning motivation, and clarifying lesson content (Journal 1). Canva was chosen because it offers attractive illustrations, including cartoons and a variety of 3D shapes. By presenting learning materials in an engaging visual format, it provides opportunities for creativity, encourages collaboration, and enhances students' interest and engagement in the learning process (Journal 2). Below is the cover design of the textbook that has been developed:
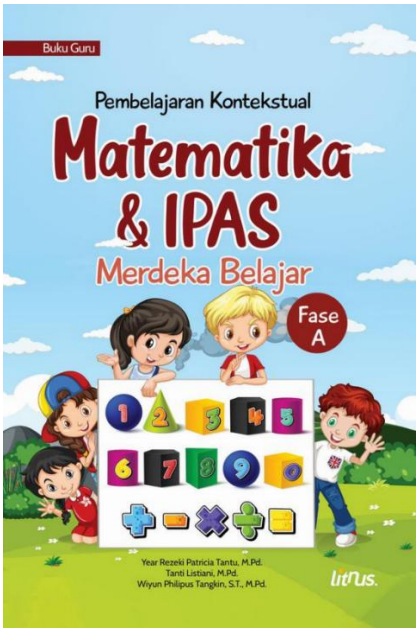
Figure 2. Textbook Cover

Before publication, the textbook entitled "Contextual Learning of Mathematics and IPAS Merdeka Belajar Phase A" underwent validity testing by three experts (see Figure 2). The validation was conducted to test the suitability of the book before it was distributed and ready for use. The following Table 1 are the results of the validation by three validators:

Table 1. Validator Assessment Results

No.	Aspect	Validator Assessment Results			Max Score	
		1	2	3		%
1	Content Suitability	7	7	8	24	91.67
2	Language Suitability	6	5	6	28	94.44
3	Presentation Suitability	8	6	10	30	80
4	Image Suitability	3	5	5	15	86.67
	Average					88.19

Table 1 shows that the feasibility test obtained a percentage of 91.67%, while the language feasibility test obtained a percentage of 94.44%. The presentation feasibility obtained an average of 80, and the image feasibility obtained a percentage of 86.67%. According to the feasibility criteria, it can be said that all scores above 75% indicate that the book is suitable for use; however, revisions are indeed needed to further improve the book.

Table 2. Textbook Eligibility Criteria

Scala (%)	Eligibility Criteria
85-100	Eligible with excellent rating
65-84	Eligible with good rating
45-64	Eligible with fair rating

Scala (%)	Eligibility Criteria
0-44	Not eligible

Source: Center for Books and Curriculum, 2008

The following are suggestions provided by the validator:

Table 3. Validator Comments

No	Aspect	Validator Suggestions
1	Content Suitability	Several questions need to be adjusted and then adapted to the context.
2	Language Suitability	There are inconsistencies in the jargon and numbering.
3	Presentation Suitability	• Very suitable for children, but needs to be adapted for use by teachers. • There are inconsistencies in font type and size. • The spacing between lines in the standard text is inconsistent.
4	Image Suitability	Adjust the images to match the content, and adjust the illustrations within them.

The validators' suggestions were then used to revise the textbook and develop it by the suggestions provided. After being revised, the textbook was published and obtained intellectual property rights. After the book was published, it was distributed to PGSD students to gauge their response. Data on student responses were collected using a Likert scale questionnaire.

The following are the results of the questionnaire completed by 48 student respondents who are prospective elementary school teachers.
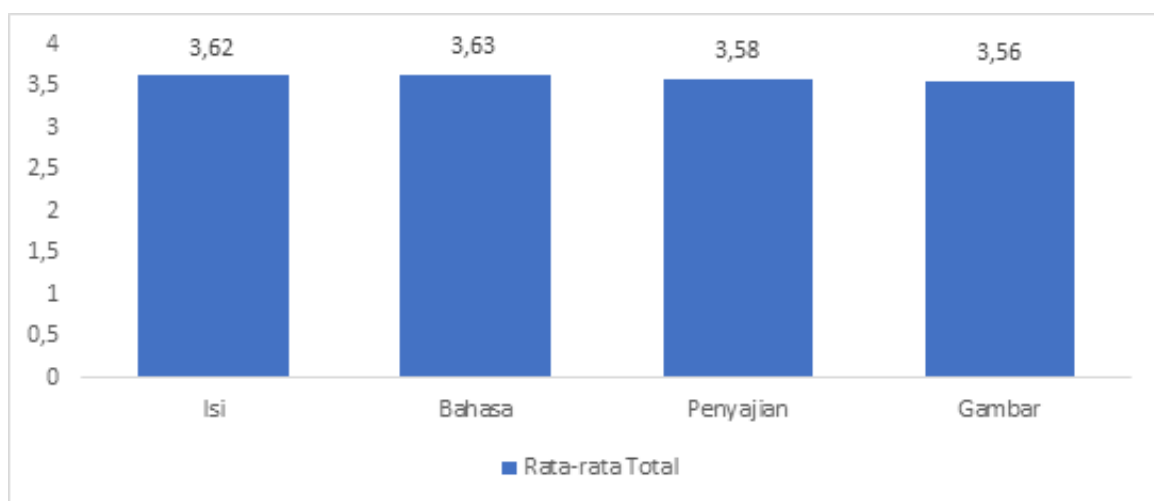
Figure 2. Student Assessment Results for Textbooks

Figure 2 shows excellent assessment results, namely 3.62, for the content of the textbooks created. This is evident from the meaningful lifelong understanding of students' lives, and the material presented can help achieve learning outcomes by the Merdeka curriculum. The textbook includes contextual learning activities tailored to the needs of elementary school students. In terms of language, the average student evaluation is 3.63, which is categorised as very good. This is evident in the arrangement of words and sentences. Additionally, the instructions and guidelines provided in the textbook are understandable. In terms of presentation, the students' assessment is still excellent, at 3.58. This is evident from the attractive book design, the proportional selection of colours and font types, as well as the neatly and systematically arranged text and images. In the final aspect, namely images, the students also provided an excellent assessment, with an average score of 3.56. The image components can help students understand the book's content more effectively. The images selected in the textbook are clear and not blurry, and they are placed in appropriate locations within the textbook.

Unlike conventional textbooks, this product is designed in an integrated and contextual manner, combining Mathematics and Science learning outcomes into a single thematic unit. Hands-on, project-based activities complement it. This approach provides students with a more meaningful learning experience by connecting abstract concepts to the real world, fostering critical thinking, collaboration, and problem-solving skills from an early age. While conventional textbooks tend to focus more on problem-solving exercises and memorising concepts, this book offers exploration activities, simple experiments, and mini-projects that enable students to learn actively and reflectively. Therefore, this product has the potential to be an innovative and relevant alternative in supporting the implementation of the Merdeka Curriculum.

5. CONCLUSION

This study successfully developed a context-based Mathematics and IPAS textbook for elementary school students in Phase A, aligning with the principles of the Merdeka Curriculum. The textbook is designed to create a meaningful learning process that is relevant to students' daily lives and integrates across subjects. Through an R&D approach using the 4-D model, the textbook was developed based on teachers' needs, curriculum analysis, and validation by experts. The textbook was deemed suitable for use, with a suitability percentage above 85% across all aspects (content, language, presentation, and illustrations). The textbook also received very positive feedback from prospective teachers, who found the content, language, and visualisations of the textbook highly helpful in understanding concepts and designing lessons.

The textbook has the potential to become a practical and relevant learning medium in supporting the implementation of Merdeka Belajar at the elementary school level. Teachers are encouraged to use this textbook as a resource for Mathematics and IPAS instruction in Phase A, as it has proven to be suitable and has received positive feedback from prospective teachers. Schools and curriculum developers may consider integrating this book into thematic learning programs as an example of teaching materials that align with the principles of Merdeka Belajar. This book can also serve as a reference for developing similar materials at different stages and levels. Further research is needed to test the effectiveness of this textbook in real-classroom implementation, either through experimental studies or long-term observations, to assess its impact on students' conceptual understanding and learning interest.

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Appendix 1:

LEMBAR VALIDASI INSTRUMEN VALIDITAS BUKU AJAR KONTEKSTUAL MATEMATIKA DAN IPAS FASE A

Nama Validator   : _____

NIK   : _____

Instansi   : _____

Bidang Ilmu   : _____

Tanggal Validasi   : _____

Petunjuk validasi:

Berilah tanda centang (V) pada kolom yang sesuai dengan penilaian Anda dan berilah komentar atau perbaikan yang perlu dilakukan dalam instrumen validitas buku ajar yang ada.

	Aspek Penilaian	Indikator	Uraian	Nilai		
				Sesuai	Tidak sesuai	Komentar
1	Kelayakan Isi	Isi materi bermakna dalam kehidupan siswa	Setiap bab memiliki pemahaman sepanjang hayat yang bermakna untuk kehidupan siswa			
		Kesesuaian materi buku dengan capaian pembelajaran fase A kurikulum merdeka	Kegiatan pembelajaran dapat membantu siswa mencapai capaian pembelajaran fase A Kurikulum Merdeka			
		Materi yang disajikan akurat sesuai dengan konsep Matematika dan IPAS	Materi yang disajikan dalam buku ajar tidak memiliki kesalahan konsep			
		Isi materi buku dapat menstimulus kompetensi siswa fase A	Kegiatan pembelajaran mampu menstimulus pengetahuan dan keterampilan siswa fase A			
		Aktivitas pembelajaran sesuai dengan tahapan perkembangan siswa fase A	Kegiatan pembelajaran sesuai dengan tahapan perkembangan siswa fase A			
		Permasalahan yang disajikan sesuai dengan konteks siswa fase A	Permasalahan yang disajikan sesuai dengan konteks siswa fase A			

		Materi yang disajikan mudah dipahami oleh siswa fase A	Materi yang disajikan mudah dipahami oleh siswa fase A			
		Materi yang disajikan berbasis kontekstual	Kegiatan pembelajaran dapat dilakukan baik di rumah maupun sekolah karena bersifat kontekstual			
2	Kelayakan Bahasa	Menggunakan bahasa sesuai dengan kaidah EYD	Penggunaan kalimat tersusun sesuai dengan SPOK			
			Penggunaan kata sambung dan imbuhan sesuai dengan kaidah EYD			
		Menggunakan tanda baca sesuai dengan kaidah EYD	Penggunaan tanda baca sesuai dengan tempatnya			
		Menggunakan bahasa yang lugas dan mudah dipahami (kalimat yang tidak ambigu)	Bahasa yang digunakan lugas			
			Setiap kalimat tidak ambigu sehingga mudah dipahami			
		Tidak ada kesalahan penulisan	Tidak terdapat kesalahan penulisan baik huruf maupun kata pada isi buku			
3	Kelayakan Penyajian	Ukuran buku ajar sesuai dengan standar ISO	Ukuran buku ajar mengikuti standar ISO			
		Ilustrasi sampul buku ajar menggambarkan isi/materi ajar dan mengungkapkan karakter objek	Desain sampul buku menarik			
			Desain sampul buku menggambarkan isi buku			
		Warna sampul buku harmonis	Warna judul sampul buku kontras dengan warna latar belakang sampul			
		Ukuran huruf judul, sub judul, dan teks pendukung buku proporsional	Ukuran huruf pada sampul buku proporsional			
			Ukuran huruf pada sub judul dan seluruh teks buku proporsional			
		Penggunaan variasi huruf tidak berlebihan	Penggunaan variasi huruf tidak berlebihan			

		Spasi antar baris susunan pada teks normal	Spasi antar baris susunan pada teks proporsional			
		Kesesuaian ukuran margin dan kertas pada buku ajar	Ukuran margin proporsional dengan ukuran kertas pada buku			
		Tersusun rapi, runtut dan sistematis	Teks dan gambar tersusun rapi dan sistematis			
4	Kelayakan Gambar	Kesesuaian gambar dengan pesan teks (materi)	Gambar yang digunakan pada buku ajar membantu pembaca memahami pesan teks			
		Penempatan ilustrasi, tabel/ grafik pada buku sesuai pada tempatnya	Letak gambar sesuai dengan tempatnya			
			Terdapat judul pada gambar dan tabel yang diberikan			
		Ilustrasi atau gambar berkualitas baik	Gambar terlihat dengan jelas dan tidak buram			
		Ukuran ilustrasi, tabel/ grafik proporsional	Ukuran ilustrasi, tabel/ grafik proporsional (tidak terlalu besar atau tidak terlalu kecil)			

Tanda Tangan Validator

_____