Scientia Publica Media

Research Article

Developing Artificial Intelligence (AI)-Based Children's Storybooks through Fry Readability for Elementary Students

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Abstract
Education in Indonesia shapes children's character, personality, and abilities, but faces challenges like unequal access to resources, quality differences between regions, and low reading interest among children. This study aims to develop AI-based children's storybooks through the Fry readability for elementary students. This study used the ADDIE model, which includes Analysis, Design, Development, Implementation, and Evaluation. Results showed that AI-based storybooks can improve children's reading interest and help teachers provide support based on students' competence. The score of Expert validation was 37 out of 40 (92.5%), and media expert validation was 52 out of 55 (94.5%). Fry readability ensures the reading level is suitable for fourth to sixth-grade students to improve the quality of elementary education in Indonesia, reduce regional quality gaps, and improve students' academic performance. The AI-based storybooks significantly boost children's interest in reading, address low reading engagement, assist teachers in offering more effective educational support, and help bridge educational quality gaps between different regions. The alignment with children's cognitive development ensures engaging and developmentally appropriate content, demonstrating an innovative approach to educational tools and paving the way for further technological integration in education. Therefore, the development of AI-based children's storybooks with the Fry readability approach not only increases children's reading interest but also assists teachers in providing more specific support according to students' abilities. This innovation is expected to positively impact the quality of elementary education in Indonesia, help address educational quality disparities between regions, and enhance students' academic achievements at the national level.

Keywords: Artificial Intelligence, Children's Storybooks, Fry Readability, Elementary School

1. INTRODUCTION

Education plays a crucial role in shaping children's character, personality, and capabilities, which become the foundation for the future generation. (Limpo et al., 2018). Within this framework, education is not only a process of knowledge transfer but also a long journey that shapes individual identity, broadens horizons, and prepares generations to face various life dynamics. (Baporikar, 2016). Through education, Indonesia creates generations who not only possess academic intelligence but also social skills, creativity, and a lifelong learning spirit (Hapudin, 2021). Education in Indonesia is a means to promote inclusiveness, diversity, and the development of globally competitive human resources.

The reality is that education in Indonesia faces complex challenges, including equal access to educational resources (Safiq Maulido et al., 2023), quality disparities between regions (Madekhan, 2021), and issues in improving children's reading interests (Yeo et al., 2014). These challenges reflect different

access and quality of education that students receive across the country. The results of the Program for International Student Assessment (PISA) 2022, announced on December 5, 2023, provide a clear picture of Indonesia's position in international student skills levels. In these results, Indonesia ranked 68th with scores in mathematics (379), science (398), and reading (371) (Ibda, 2019). This position highlights significant challenges in improving the quality of education in Indonesia.

The relatively low ranking has shown a gap in Indonesian students' academic achievements compared to students from other countries. Thus, there is an urgent need to solve the different educational quality between regions, ensure all students in Indonesia have equal access to quality education, and elevate academic standards. In addition, PISA results show challenges in increasing children's reading interest in Indonesia. The relatively low reading score shows that the education sector needs to build a literacy culture among children and encourage a love for reading (Yeo et al., 2014). These issues create innovative opportunities to enhance children's reading interests, such as developing AI-based children's storybooks or more interactive and engaging learning approaches.

With the PISA results, integrating AI-based children's storybooks can be a solution to respond to PISA findings. For example, children's storybooks can be focused on improving students' reading skills. By using PISA data, developing AI-based children's storybooks can be the solution for educational quality disparities between regions and enhance students' academic achievements nationally (Cruz-Jesus et al., 2020). In the 4th industrial revolution, the era of information technology and the development of artificial intelligence (AI) have become key factors in shaping changes in the educational world (Alias et al., 2018; Chasokela & Hlongwane, 2025; Samara & Kotsis, 2025). In this context, developing AI-based children's storybooks becomes an innovative solution that can enrich the learning process, especially at the elementary school level.

Information technology and artificial intelligence, both integrating technology into learning, become increasingly important (Amdan et al., 2025; Chasokela, 2025; Chen et al., 2020; Mosae & Kaushal, 2025). The use of artificial intelligence in developing children's storybooks brings innovations that can personalize children's reading experiences (Yang, 2022). By applying the Fry readability concept, which measures the difficulty level of reading, AI-based children's storybooks can be given to each student's comprehension and reading abilities. This is expected to improve the effectiveness of learning and stimulate children's reading interest at the elementary school level.

By applying the Fry readability concept in developing AI-based children's storybooks, elementary school learning can achieve a higher level of personalization (Pantula & Kuppusamy, 2022). This concept gives opportunities to tailor storybook content specifically to each student's comprehension and reading abilities. As an educational innovation, AI-based children's storybooks with the Fry readability approach are not just technology but also a responsive tool to individual student needs.

AI-based children's storybooks can become adaptive learning partners, ensuring every child can explore the world of literacy according to their readiness level. (Sabatini et al., 2023). Fry readability as a proven method provides an objective foundation for measuring reading difficulty levels so that children's storybooks can be set appropriately, not too easy or too difficult. (Nugrahani et al., 2024).

The Fry readability concept applied in AI-based children's storybooks provides an objective to measure reading difficulty levels. The Fry formula makes each story material adaptable intelligently and appropriately, preventing storybooks from becoming too easy or difficult for students. (Khusnaini & Nugraheni, 2020). This level of difficulty adjustment can stimulate challenges appropriate to students' abilities, encouraging their literacy development without making it too easy or frustrating. (Sukmawati et al., 2023). Thus, AI-based children's storybooks with the Fry readability approach are not only smart learning tools but also tools that can stimulate children's reading interest, assist teachers in providing more specific support, and ultimately positively impact the quality of elementary education.

Previous research has developed children's storybooks for early reading (Bus et al., 2015), further developed fable storybooks in elementary schools (Wati & Gularso, 2022), and recently developed children's reading books according to environmental care characters for elementary school students (Birhan et al., 2021). Based on preliminary studies conducted by researchers, a gap was found, namely that the development of children's storybooks was still done manually, making the appearance of the books less attractive. Moreover, the development of the texts in the books was not based on readability calculations,

resulting in reading texts that were too long and potentially inappropriate for the student's age or grade. Therefore, the novelty of this research lies in integrating artificial intelligence in various aspects of children's storybook production, involving AI elements and Fry text readability analysis to ensure suitability with the students' grade levels.

2. METHODS

This study used the ADDIE model, consisting of five stages: Analysis, Design, Development, Implementation, and Evaluation (Muruganantham, 2015). The ADDIE development process in this study only includes the Development stage because the focus of this research is to produce valid learning media based on evaluations from validators. The stages of this development research can be outlined as follows:

2.1. Analysis

In this stage, the focus is on product development through material analysis and learning needs analysis.

2.1.1. Material Analysis

Curriculum Documents: Material analysis begins with an in-depth review of the current official curriculum documents. This includes understanding the competency standards, essential competencies, and learning objectives set by the educational authorities. This information serves as the foundation for detailing the content to be presented in the children's storybook.

2.1.2. Learning Needs Analysis

a. Teacher Interviews: To understand the specific and contextual learning needs at the elementary level, interviews are conducted with experienced teachers. These interviews aim to gain direct insights into student needs, learning preferences, and potential challenges in everyday learning environments.
b. Student Needs Assessment: Through teacher interviews, a deep understanding of students' profiles, learning styles, and areas requiring special attention is obtained. This information helps in designing a children's storybook that is not only aligned with the curriculum but also relevant and engaging for students.
c. Identification of Learning Challenges: Interviews also provide an understanding of the learning challenges that students may face. This information is crucial for creating content that can help overcome learning difficulties and enhance student comprehension.

2.2. Design

a. Designing Children's AI-based Storybooks: In this stage, the children's storybook design is carried out using artificial intelligence (AI). The design includes the implementation strategy of AI in crafting children's stories to meet the needs and readability of each grade level.
b. Analyzing Text Readability Using Fry Graph: During the design phase, text readability analysis is performed using the Fry graph. This analysis aims to ensure that the reading difficulty level of the children's storybook matches the students' comprehension levels across different grades.
c. Validation Sheets for Media and Material Experts: Validation sheets are prepared and provided to media and material experts during the design phase. These validation instruments, in the form of questionnaires, are used to gather feedback and evaluations from both groups of experts.

2.3. Development

a. Development Results: The development stage results in developing children's storybooks and validation scores for the material and media. The children's storybook is the main product developed using artificial intelligence, while the validation scores provide an overview of the material and media validity levels.
b. Validity Testing: Validity testing of the children's storybook is conducted by media and material expert validators. Validators are asked to assess the quality of the developed material and media and provide suggestions for improvements.
c. Evaluation and Suggestions: Validators provide an overall assessment of the children's storybook and offer constructive suggestions for further media development. This feedback forms the basis for refining and perfecting the product before the implementation stage.

These stages include material and media analysis, designing AI-based children's storybooks and readability analysis, and product development involving media and material experts to ensure the quality and validity of the resulting learning media.

3. RESULTS

3.1. Development Process of AI-Based Children's Storybooks and Fry Readability Graph

The development process of AI-based children's storybooks using an image generator involves several critical stages. First, during the planning and research stage, writers and illustrators plan the story and conduct in-depth research on the themes, characters, and settings to be used in the children's storybook. This research includes identifying the target audience, which in this case is fourth-grade elementary school students, determining the visual style in the form of cartoons, and designing a plot that tells the story of high-achieving students. The second stage is writing the manuscript, where the writer starts writing the children's story manuscript, including dialogues, narratives, and the story's structure. This manuscript will serve as the main guide for developing illustrations and the overall storyline of the book. Next, during the illustration creation stage, an AI image generator is used to create colourful illustrations according to the storyboard. Illustrations are made based on the previously compiled descriptions. An example image at this stage is the illustration of each character.

Figure 1. Picture Made using AI

When completing illustrations. The next stage is combining illustrations and text. The book layout is arranged so that the text and images complement each other and are easy for children to understand. An example of the resulting image is a book page with complete text and illustrations. After that, the book that has been laid out will be reviewed during the editing and revision stage to ensure there are no mistakes in the text or images. The final stage is finalization and publication, which includes final format checking, delivery format, and preparation for publication in both print and digital forms. This process ensures that

the children's storybook is ready to be enjoyed by its readers. Then, calculate text readability using the Fry graph. The graph shows that the developed reading book is suitable for fourth, fifth, and sixth-grade students.
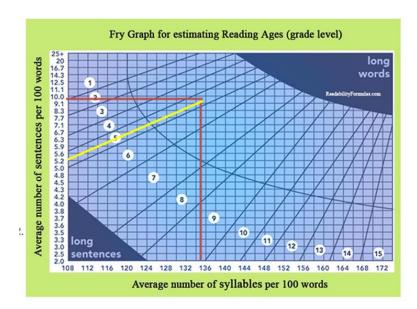

Figure 2. Text Readability using the Fry Graph

3.2. Expert Validation Result

The following are the results of material and media expert validation, detailed in Table 1 below.

Table 1. Material Expert Validation Results

No	Assessment Aspect	Score				
		1	2	3	4	5
1	Material Suitability with Children's Age					
	Material is appropriate for children's cognitive development.				√	
	The story is easy to understand by children according to the target age.					√
2	Language Quality					
	Simple and easily understood language				√	
	The language used is attractive and motivates children to read.					√
3	Suitability of Values and Moral Messages					
	The story contains good moral values.					√
	The moral message is conveyed clearly and not preachily.					√
4	Illustration and Visuals					
	Illustrations support the story and attract children's attention.				√	
	Images and colours are appropriate for children's age.					√
	Total			**37**		
	Percentage			**92.5%**		

The table shows that the children's storybook got a total score of 37 out of a maximum of 40, with an assessment percentage of 92.5%, showing that the book is highly suitable and effective in supporting cognitive development, language comprehension, and the instillation of moral values in children, according to the target age. Next, the results of media expert validation are presented in Table 2.

Based on the results of the media expert validation instrument for the children's storybook, the book shows very high quality with a total score of 52 out of a maximum of 55, resulting in an assessment percentage of 94.5%. This indicates that this book is highly suitable for the target children's age, using simple and easily understood language, and is very attractive to fourth-grade elementary school students.

Table 2. Media Expert Validation Results

No.	Assessment Aspect	Indicator	Score				
			1	2	3	4	5
1.	Design Appearance	1. Suitability of colours and images				√	
		2. Consistency of page layout					√
2.		1. Ease of navigation					√
	Interactivity	2. User interaction response					√
		3. Suitability of interactive functions with content					√
3.	Animation and Graphics	1. Animation quality				√	
		2. Relevance of animation to the story					√
		3. Clarity and detail of images				√	
4.	Suitability with Audience	1. Simplicity of language used					√
		2. Content suitability with children's age					√
		3. Attractiveness and motivation for children to read					√
	Total				**52**		
	Percentage				**94.5%**		

4. DISCUSSION

The development of AI-based children's storybooks with the Fry readability approach has great potential to improve the quality of elementary education in Indonesia. This development process starts with the planning and research stage, where writers and illustrators conduct an in-depth analysis of relevant themes, characters, and settings for the target audience, which is fourth-grade elementary school students. This research is crucial to ensure that the book's content is appropriate for children's cognitive development and can attract their reading interest. (McGeown et al., 2016).

The manuscript writing stage involves creating clear and easily understood dialogues, narratives, and story structures for children. Using simple and engaging language is crucial in this process to ensure children can easily understand the story. (Johnston, 2024). Next, using AI in illustration creation allows for more engaging and interactive images, enhancing children's involvement in reading. (Ng et al., 2022). The stage of combining illustrations and text is a critical step in creating a book that is not only informative but also visually appealing. Using a consistent and interactive layout helps children understand the story better and increases the book's visual appeal. (Kao et al., 2016). The editing and revision process ensures the book is free from errors and meets the desired quality standards. (Chua et al., 2017).

Expert validation results show that the AI-based children's storybook is highly suitable for use. High validation scores from material and media experts indicate that the book is suitable for children's cognitive development, uses simple and easily understood language, and has attractive illustrations that support the story. (Sari & Suryana, 2019). Media expert validation also shows that the book has an attractive, interactive design and is appropriate for the targeted audience. Using Fry's readability in developing this book also ensures the reading difficulty level is appropriate for students' reading abilities. (Tunde-Awe et al., 2020). The Fry formula provides an objective foundation for measuring reading difficulty levels so that the book's content can be adjusted according to each student's abilities.

Therefore, the development of AI-based children's storybooks with the Fry readability approach not only increases children's reading interest but also assists teachers in providing more specific support according to student abilities. This innovation is expected to positively impact the quality of elementary education in Indonesia, help address educational quality disparities between regions, and enhance students' academic achievements at the national level.

4. CONCLUSION

The development of AI-based children's storybooks using the Fry readability approach demonstrates significant potential in supporting literacy instruction and enhancing the quality of elementary education in Indonesia. By ensuring an appropriate level of reading difficulty for fourth to sixth-grade students, these storybooks allow teachers to better align reading materials with students' abilities, thereby improving both

engagement and comprehension. Expert validation results confirm the book's high suitability, highlighting its relevance to children's cognitive development, clear and accessible language, and appealing illustrations. This innovation offers practical applications: teachers can incorporate AI-generated storybooks into classroom instruction, curriculum developers may adopt similar tools to improve literacy programs, and school administrators can evaluate readability using digital resources. Overall, this study not only contributes to academic discourse but also provides a scalable and evidence-based solution for addressing educational disparities and advancing digital literacy in diverse classroom settings.

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