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Development of E-Book Media to Foster Traffic Awareness in Early Childhood

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Abstract

Traffic awareness is an important aspect that needs to be instilled from an early age, as children are among the most vulnerable groups to road accidents. This study aims to design an e-book entitled "Let's Get to Know Traffic Signs" as a learning medium for traffic awareness education in early childhood, intended for use by teachers. The method used is Educational Design Research (EDR), which includes three main stages: analysis and exploration, design and construction, and evaluation and reflection. Data were collected through interviews with early childhood education teachers, validated by media and content experts, and implemented through the traffic awareness e-book. The study was conducted at School X in Sukajaya District, Bogor Regency. The result of this development is an e-book that is considered suitable for early childhood. The validation process involved media and educational content experts using validation questionnaires and usability testing. The research involved 30 students in early childhood education. The findings demonstrate that the e-book, based on expert validation and its application with students, is a feasible educational medium for building traffic awareness in early childhood.

Keywords Early Childhood; E-book; Traffic Awareness

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1. INTRODUCTION

Traffic awareness is a crucial issue that directly impacts public safety, especially among vulnerable groups such as children. Children often lack the cognitive ability and experience to recognize traffic risks, making it essential to use educational approaches suited to their developmental stage. Traffic awareness in children can be fostered through direct experiences in real-life environments (Santrock, 2011). Field trips, for instance, enable children to learn about traffic signs and regulations concretely, making it easier for them to understand the ethics of crossing and driving from an early age. This approach is considered more effective because it offers a fun, meaningful, and contextual learning experience (Indarti, 2021).

Traffic awareness is a state in which road users are protected from the risks that arise from

interactions between humans, vehicles, and the environment, making it essential to teach traffic safety from an early age (Setijowarno, 2025). Self-safety is a fundamental aspect of early childhood education aimed at fostering awareness of environmental dangers. This effort involves key principles such as hazard recognition—guiding children to identify risky objects or situations, understanding danger—explaining why certain situations can be harmful, taking preventive actions—helping children avoid dangers before they occur, and behavior control—enabling them to make appropriate decisions in dangerous situations (Justicia et al., 2023a).

Traffic accidents are a leading cause of death and injury globally, especially in low-income countries. In Indonesia, traffic accidents continue to pose a serious challenge (World Health Organization, 2018). Data from the National Traffic Corps (Korlantas Polri) in 2024 recorded between 152,000 and 220,647 accidents, resulting in over 27,000 deaths. Motorcycles accounted for the majority—76.42% or approximately 552,155 vehicles involved (Kusumastutie et al., 2024).

These facts underscore the importance of promoting traffic safety and compliance with road regulations. One critical form of such compliance is understanding and obeying traffic signs, which play a vital role in guiding and regulating road users. In accordance with the Ministerial Regulation (PERHUBUNGAN, 2014)Traffic signs are road equipment that provide warnings, prohibitions, instructions, or guidance to road users using symbols, letters, numbers, phrases, and combinations thereof, emphasizing the need to cultivate traffic awareness from an early age (Dwipayana, 2025).

Traffic awareness education in early childhood encompasses three main aspects: cognitive, affective, and psychomotor, which are interrelated. In the cognitive aspect, children are taught to recognize basic traffic signs such as stop signs, caution signs, and traffic lights. Children's cognitive and affective development can be explained through several foundational learning theories. Children in the preoperational stage begin to construct understanding through symbolic representation, making visual media—such as traffic signs—effective tools for introducing basic concepts (Piaget, 1952). Further emphasizes that cognitive growth is shaped through social interaction and scaffolding provided by adults, which helps children interpret rules and real-world situations, including those related to traffic safety (Vygotsky, 1978). Social learning theory highlights that children acquire behaviors through observation and imitation, suggesting that modeling safe behavior by parents and teachers plays a crucial role in shaping children's understanding of safety practices (Bandura & Walters, 1977). From an affective perspective, Kohlberg notes that young children are typically in the pre-conventional stage of moral development, where rule-following is motivated by the desire for rewards or the avoidance of punishment. Therefore, traffic safety education becomes an important avenue for fostering responsibility and concern for the well-being of themselves and others. Explained that social interaction plays an important role in children's development, including through activities that involve moral values such as traffic safety (Vygotsky, 1978). The psychomotor aspect is carried out through direct practice, such as simulating crossing the street at a zebra crossing or stopping at a red light. "Through direct experiences, children can develop relevant and vital skills for their safety on the road" (Piaget, 1977).

Teaching traffic awareness to early childhood learners involves cognitive, affective, and psychomotor aspects. First, children are expected to recognize basic traffic signs such as stop signs, caution signs, and traffic lights. This aligns with the preoperational stage described by (Santrock, 2011), where children begin to understand visual symbols as representations of meaning. Second, children exhibit caution near roads, such as walking on sidewalks or crossing at zebra crossings—behavior shaped by social learning, where they imitate those around them. Third, they can practice the "4-L" procedure (Stop for a moment, Look right, Look left, Look right again) as a form of directed motor skill training, in line with motor development theories by (Goodway et al., 2019).

Traffic discipline is an essential aspect that should be instilled from an early age. Children, as one of the most vulnerable groups on the road, need to be introduced to the concept of traffic safety through

enjoyable, simple, and developmentally appropriate methods. The purpose of traffic safety education is not only to teach traffic rules but also to shape children's character to become disciplined and responsible individuals. According to (Santi, 2015) The introduction of safety education at an early age has been proven to reduce pedestrian fatality rates, as children can understand basic procedures for crossing the road safely. This is in line with (Verina et al., 2024) Research has shown that implementing safety education in early childhood can promote safe traffic behavior through developmentally appropriate approaches.

According to (Jayadinata et al., 2024) Self-awareness instilled early through the introduction of responsibility forms the foundation for children's discipline. These values are crucial as basic character traits that must be developed early on to ensure children grow into law-abiding and safety-conscious road users. This is in line with (Purwanto, 2017) Who stated that consistent early exposure to traffic discipline can embed such behavior as part of a child's cultural habit?

Further emphasize that fostering positive behavior in children is more effective when done comprehensively and repeatedly through thoughts (habits of the mind), feelings (habits of the heart), and actions (habits of the action) (Cahyaningrum et al., 2017). Through this approach, important values, such as traffic safety, can be deeply ingrained in a child's character from an early age. The importance of traffic safety education in early childhood is further supported by the National Education System Law, as cited by Fauziddin (2017), which states that early childhood education aims to stimulate learning to support holistic growth and development. At this stage, children are in the preoperational phase (Santrock, 2011), where they cannot yet independently recognize danger and still require guidance and supervision from adults.

Interactive e-books serve as an enjoyable learning medium while significantly enhancing children's learning motivation. They not only facilitate the understanding of concepts but also provide flexible and adaptive learning experiences tailored to students' needs. Moreover, interactive e-books do not merely increase learning interest but also reduce boredom during the learning process (Rangkuti et al., 2024).

Therefore, providing understanding about traffic safety must be tailored to children's age and cognitive developmental stage. In line with this, (Cholimah et al., 2020) Emphasized that traffic education for early childhood must be delivered simply, focusing on basic understanding of appropriate road behavior for personal and public safety. In today's modern learning context, the use of digital technology as an educational tool becomes highly relevant. Technological advancement offers great potential to deliver learning media that is more engaging and interactive. One such innovative tool is the interactive e-book, which presents content in a visual and multimodal format—combining text, images, audio, video, and animation—to not only capture children's interest but also facilitate their comprehension (Susantini, et al., 2021). Interactive e-books are enjoyable learning tools that significantly increase children's learning motivation.

Previous studies have demonstrated the importance of interactive learning media in supporting early childhood understanding of traffic safety and traffic signs (Justicia et al., 2023a). Developed a Smart Book based on a self-protection program for young children using the Educational Design Research (EDR) approach, which was validated by experts and utilized by both teachers and parents. Although the primary focus was on environmental dangers such as strangers or natural disasters, the media served as an innovative tool for educating young learners. Designed an educational game called *Ingat Rambu* (Remember the Signs), based on Adobe Flash, in the form of a memory-matching card game aimed at introducing traffic signs to children (Ilham & Karim, 2022). This game emphasized memory skills through a simple and interactive user interface. Developed a learning media using Augmented Reality (AR) technology, equipped with 2D animations, audio, and interactive games to introduce traffic signs. Created a marker-based AR application featuring 3D animations of traffic signs, designed for use on mobile devices within kindergarten settings (Islamy & Frieyadie, 2019).

However, each of these studies presents certain limitations that define the research gap. The Smart

Book, developed by Justicia et al., did not specifically address traffic safety and was not produced in the form of a digital e-book that could be used independently by children. Although Saleh's (2018) *Ingat Rambu* application was interactive, it only offered one type of activity and was built with Adobe Flash, a platform now obsolete and unsupported by modern systems. Meanwhile, AR-based media, as developed by Islamy & Frieyadie (2019), rely on high-end technologies and specific devices, making practical implementation difficult in most early childhood education settings, especially in regions with limited technological infrastructure. Moreover, these studies lacked pedagogical validation and did not fully integrate early childhood developmental characteristics in their media design.

Several recent studies support the development of interactive, developmentally appropriate digital media for early childhood. For instance, (Djamali & Kharismawati, 2023) Developed an e-book for science learning in kindergarten, which demonstrated very high usability and effectiveness. Demonstrated that interactive multimedia (games, animation, flash cards) significantly increases young children's motivation and self-directed learning (Firdaus & Prasetyo, 2025). Designed thematic interactive digital media on the universe to foster scientific thinking (Rahmawati et al., 2024). In addition (Adawiah et al., 2023) Adawiah, Gandana & Rahman (2023) found that digital flip-books enhance language skills, and (Sari & Suyadi, 2024) Argued that interactive games generate an immersive and engaging learning environment for preschoolers.

This study aims to design and develop an interactive e-book entitled *"Let's Get to Know Traffic Signs"* that not only delivers educational and engaging content but is also specifically designed to align with the cognitive developmental stages of early childhood. The e-book is expected to serve as a learning medium that supports teachers in introducing traffic awareness from an early age, while also contributing to national programs that promote traffic safety campaigns for children.

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2. METHODS

The research design used in this study is Educational Design Research (EDR). EDR is an approach aimed at solving a problem by designing and developing a solution in the form of programs, materials, and learning or teaching strategies, which may also take the form of a product or system (Lidinillah, 2012).

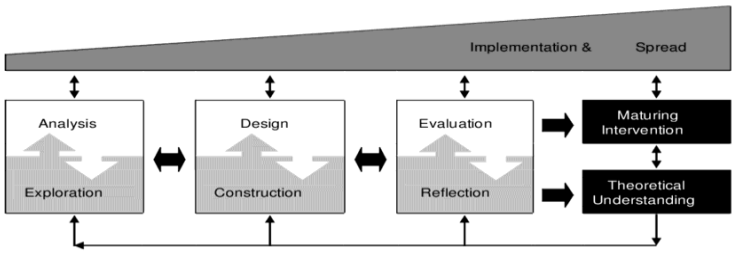

Figure 1. Generic EDR Model (McKenney & Reeves, 2012)

Based on the generic EDR model by (McKenney & Reeves, 2012) The EDR research process consists of three main stages:

a. Analysis and Exploration – In the first stage, the researcher focuses on analyzing and exploring the problem through literature review and preliminary studies conducted in schools, including

interviews with teachers about traffic safety education for early childhood. This stage provides direct insights into the current teaching practices.

b. Design and Construction – The next stage aims to design and develop solutions based on the results of the previous analysis. This process is iterative, allowing the initial design to be revised multiple times based on feedback and trials.

c. Evaluation and Reflection – The final stage aims to assess the effectiveness of the designed solution and reflect on the development process for further improvement. Evaluation is carried out through both formative (during the process) and summative (after implementation) approaches.

This study was conducted at Darul Fallah Playgroup (KB) located in Sukajaya District, Bogor Regency, West Java Province. The selection of this location was based on the compatibility of the school's characteristics with the research objectives, namely the development of learning media for early childhood in the context of traffic awareness. According to (Sugiyono, 2013) The selection of a research site should consider its relevance to the research focus to obtain valid data that support the achievement of research objectives. This study involved two teachers as key participants and 30 students as subjects for the media trial. This is in line with (Arikunto, 2010) Statement that teacher involvement as participants can provide more comprehensive data on the implementation of learning media, while the number of students involved as trial subjects is sufficient to examine the effectiveness of the developed media.

Data in this study were collected through several integrated techniques following the Educational Design Research (EDR) approach. The stages of data collection included: (1) Teacher Interviews, conducted in a semi-structured manner with two teachers to identify learning needs, media preferences, and suggestions for e-book development. The interview data were analyzed descriptively and qualitatively to identify key patterns and inputs that formed the basis of the initial media design. (2) E-book Development, where the information from interviews was used as the foundation for designing the "Let's Get to Know Traffic Signs" e-book. This stage resulted in a prototype that reflected the identified user needs. (3) Validation by Media and Content Experts, using evaluation instruments (validation sheets) to assess content feasibility, visual design, interactivity, and suitability with early childhood development characteristics. Quantitative data were analyzed using descriptive percentage techniques, while qualitative comments and suggestions were used to identify aspects requiring revision. (4) Media Revision, conducted based on experts' notes, inputs, and recommendations to optimize the media and meet eligibility standards. (5) Trial with Early Childhood Learners, where the validated e-book was applied to 30 children. Observations were made to examine engagement, comprehension, and responses toward the media content. Additionally, teachers provided feedback on the effectiveness of the media. The trial results were analyzed descriptively to measure the media's impact on children's understanding of traffic awareness. (6) Research Documentation. The data sources in this study included teachers, students, media experts, and subject matter experts.

According to (McKenney & Reeves, 2012) Data collection in EDR must be iterative and cyclical, involving multiple sources of evidence to strengthen the validity of the findings. (Plomp, 2013) Emphasize that triangulation of data, through interviews, expert validation, and classroom trials, is essential in ensuring that the developed product is both theoretically grounded and practically feasible. In line with this, Sugiyono (2014) highlights that in educational research, the combination of qualitative and quantitative data is necessary to provide comprehensive results. Furthermore, Arikunto (2010) explains that the involvement of both teachers and students as data sources ensures that the developed media aligns with practical needs and classroom conditions.

3. FINDINGS AND DISCUSSIONS

Data in this study were obtained through interviews with early childhood education (ECE)

teachers, validation from subject matter and media experts, and the implementation of the media with early childhood students at School (KB) Darul Fallah. The data sources in this research were used triangulatively, by combining various types of data and data collection techniques such as interviews, observations, and documentation, to ensure that the developed product is aligned with the context and needs of traffic awareness media (Denzin, 2017).

Results of Interviews with ECE Teachers

Interviews with two ECE teachers revealed that awareness of traffic safety should be instilled from an early age, even starting as early as 3–4 years old. According to them, at this age, children begin actively exploring their environment and show high curiosity, making it a crucial time to introduce traffic rules and etiquette. The teachers emphasized that when children receive proper education from an early age, they become more cautious when crossing the road, understand the function of traffic lights, recognize signs, and act responsibly around vehicles. Instilling values of discipline and responsibility on the road is expected to shape children into orderly and safe road users in the future. This aligns with Lillard (2016), who highlights the importance of structured and educational environments in shaping children's behavior through repeated real-life activities.

Therefore, providing traffic education from an early age—such as learning traffic lights, understanding signs, and practicing proper road crossing—equips children not only with knowledge but also with the character and attitude of being safe and responsible road users in the future. During the learning process, the use of creative teaching strategies tailored to the early childhood development stages is essential in delivering abstract concepts, such as traffic safety. The use of visual media such as educational videos, flashcards, storybooks, and homemade teaching aids greatly helps strengthen children's understanding of the material taught.

Based on the results of the interviews and supported by expert opinions, the researcher considers it important to develop educational media that align with the characteristics of early childhood. Therefore, this study focuses on the development of interactive e-books as a medium to instill traffic awareness from an early age. This medium is expected to serve as a fun yet effective learning tool in supporting the formation of safe behavior among children as road users. In the process of identifying learning needs, media preferences, and suggestions for e-book development, it was found that the use of visual media such as educational videos, flashcards, storybooks, games, and self-made teaching aids greatly helps strengthen children's understanding of the material taught.

According to (Mayer, 2013) Multimedia-based learning that integrates text, images, and animations can enhance children's comprehension and information retention as it aligns with the workings of dual coding theory. Explains that visual and interactive learning media have high attractiveness, thereby fostering learning motivation and facilitating children's understanding of abstract concepts. In addition, (Piaget, 1977; Santrock, 2011) Emphasized that early childhood is at the preoperational stage, where concrete learning through visuals, symbols, and direct interaction is highly effective in stimulating their cognitive development. Thus, interactive e-books are highly suitable as functional and practical learning media for teachers in delivering traffic safety education to young children.

Development of a Traffic Awareness Education-Based E-Book for Early Childhood

The development of a traffic-awareness-based e-book for early childhood education began with interviews with teachers to identify needs and gather suggestions for media design. The content of the e-book *"Let's Get to Know Traffic Signs"* includes a singing video about traffic lights to help children understand their functions (e.g., red means stop), games to classify prohibition and command signs so children can recognize and distinguish them on the road, and guidance on how to cross the street safely. This aligns with Ekapuspahati & Nurwaniasih (2015), who emphasized that traffic simulation games are effective in increasing discipline among children aged 5–6 years, as they enable children to learn traffic rules through enjoyable, hands-on experiences.

Figure 2. E-Book Cover

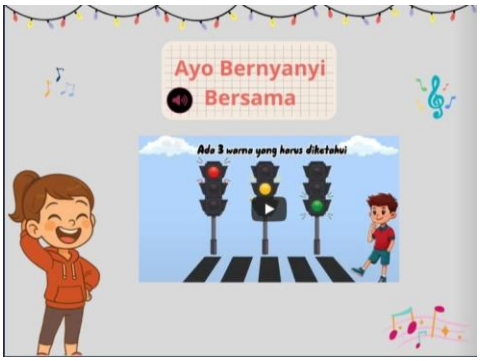

Figure 3. Video Introduction to Traffic Lights

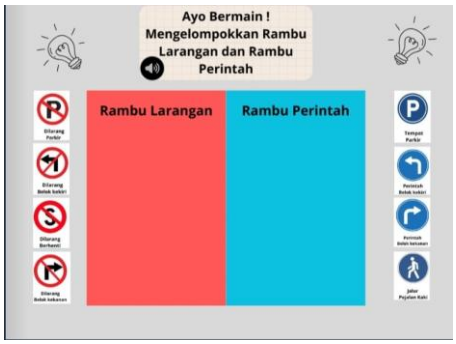

Figure 4. Grouping Game Activity

Figure 5. How to Cross the Street

Results of Media Expert and Content Expert Validation

The validation process was carried out by early childhood education (ECE) media experts and subject-matter experts to ensure that the developed e-book was not only feasible for use but also aligned with the characteristics and learning needs of young children. Media experts evaluated the technical

and visual design aspects, including graphic quality, page layout, color consistency, font size, and the interactive elements offered. In addition, readability and ease of navigation were emphasized to ensure that both children and teachers could access the content conveniently and comfortably. According to (Sumartiningsih & Priatiningsih, 2024) Well-designed visual and interactive media can significantly enhance students' motivation and engagement. This is reinforced by Sadiman et al. (2006), who highlight that the quality of media design strongly determines its effectiveness in helping children grasp concepts more concretely. (Nurhatmi, 2025) Argue that technical aspects, such as layout, color, and interactivity, play a crucial role in supporting the success of digital media as an educational tool.

The validation of the media in this study employed a Likert scale with a score range of 1–4 to assess the feasibility of the e-book. A score of 1 indicates the category is *not feasible*, a score of 2 *fairly feasible*, a score of 3 *feasible*, and a score of 4 *highly feasible*. According to (Sugiyono, 2013) The Likert scale is an effective instrument for measuring respondents' perceptions, opinions, and attitudes toward a research object. In the context of educational media development research, this scale allows researchers to obtain a quantitative overview of the feasibility of content, visual design, and interactivity aspects assessed by experts (Suharsimi, 2006).

Table 1. Media Expert Validation Assessment

Aspect	Indicator	Score	Criteria	Suggestions for Improvement
Layout	a. Layout and explanation pages are clear	4	Very Good	–
Text	b. Text in the e-book is readable	3	Good	Improve contrast between text and background for better readability
	c. Font choice is appropriate for early childhood	3	Good	Use appropriately sized fonts for effective understanding
	d. Text color is attractive for young children	3	Good	Combine contrasting colors to increase readability
	e. Text size is clear	3	Good	Ensure large enough text without disrupting the layout
Images	f. Images match the content	4	Very Good	–
	g. Image quality and resolution	4	Very Good	–
	h. Visual appearance of images	4	Very Good	–
	Total Score	**28**		
	Average	**3.5**	**Very Good**	

The table above presents the average score of the media expert validation, which is 3.5 out of 4 points, categorized as "Excellent." This score indicates that the e-book is considered highly effective in terms of its visual design and functionality as a digital medium for supporting traffic awareness learning in early childhood. However, several revision notes provided by the expert need to be addressed to improve further and refine the media.

Meanwhile, the early childhood content expert evaluated the alignment of the e-book content with the curriculum and key principles of early childhood education, including a holistic and enjoyable approach tailored to the child's developmental stage. The evaluation included the feasibility of the material, the use of simple and communicative language, relevance to the child's world, and the educational values conveyed. In addition, the integration of text, images, and activities within the e-

book was also considered to ensure a meaningful and enjoyable learning experience for children.

Table 2. ECE Expert Validation Assessment

Aspect	Indicator	Score	Criteria	Suggestions for Improvement
Media Presentation	a. Visual display is appropriate and engaging for young children	4	Very Good	–
	b. Use of color, font, and images is supportive and clear	4	Very Good	–
Content Delivery	c. Content is clear and easy for children to understand	3	Good	Add more interactive and constructive activities to support understanding
	d. Traffic material is presented in child-friendly language	4	Very Good	–
Content Relevance	e. Content completeness is aligned with early childhood traffic education	3	Good	Add interactive elements and improve accessibility (children still need adult help)
	Total Score	**18**		
	Average	**3.6**	**Very Good**	

The validation results from the early childhood education (ECE) content expert yielded an average score of 3.6, which also falls into the "Excellent" category. This validation was conducted to assess the alignment of the e-book content with the characteristics and developmental stages of young children, including the appropriateness of language use, clarity of messages, relevance of content to traffic safety learning objectives, and the material's meaningfulness for children. Based on these validation results, it can be concluded that the e-book *"Let's Get to Know Traffic Signs"* meets the eligibility criteria in terms of both content substance and visual design, and is deemed suitable for use as a learning medium for early childhood education. Through this systematic validation process, the e-book is declared feasible as an interactive learning medium that supports traffic safety education for young children. The dual validation from both experts ensures the quality of the product in terms of both media design and content feasibility, making the e-book ready for optimal implementation in early childhood education settings.

Implementation of the Traffic Awareness Education E-Book

The implementation of the traffic awareness educational e-book was carried out at School KB Darul Fallah, located in Sukajaya District, Bogor Regency, West Java Province, involving 30 young learners. During the implementation process, observations were conducted to determine the extent to which the e-book influenced children's understanding and behavior. The observed aspects included the children's ability to recognize and understand basic traffic signs, their awareness of the importance of personal safety on the road, their application of safe street-crossing procedures, and the development of discipline and a sense of responsibility. These aspects served as key indicators in evaluating the effectiveness of the e-book as a learning medium for instilling traffic awareness from an early age. Observations were also made to assess the level of engagement, comprehension, and responses of the children to the content presented in the media. In addition, teachers provided feedback on the effectiveness of the e-book in the learning process. The trial results were analyzed descriptively to assess the impact of the media on enhancing children's understanding of traffic awareness.

Table 3. Observation Results of Traffic Awareness Media Implementation

No	Indicator	Number of Children Who Meet	Total Children	Percentage
1.	Children can know and recognize basic traffic signs	26	30	86.7%
2	Children realize the importance of self-awareness on the highway	24	30	80%
3	Implementing Safe Crossing Procedures	24	30	80%
4	Developing an Attitude of Discipline and Responsibility	25	30	83,3%

Based on observations of the 30 early childhood participants after using the "Let's Get to Know Traffic Signs" e-book, it was found that the majority of the children demonstrated a positive understanding and behavior related to traffic awareness. A total of 86.7% of the children were able to identify and recognize basic traffic signs, such as stop signs, caution signs, and traffic lights. Additionally, 80% of the children demonstrated self-awareness in road environments, as evidenced by cautious behavior and compliance with guidance. Another 80% were able to apply safe procedures when crossing the street by practicing the 4-L steps (Pause briefly, Look right, Look left, and Look right again). Furthermore, 83.3% of the children exhibited disciplined and responsible attitudes in following traffic rules, both during the e-book implementation and in daily activities. These results indicate that the use of the e-book as an educational medium has had a positive impact on increasing traffic awareness among early childhood learners, both in terms of cognitive understanding and attitudes and behaviors.

4. CONCLUSION

The research findings indicate that this e-book is effective in enhancing children's understanding of basic traffic signs and promoting safe behavior when interacting in road environments. Through its interactive digital format, the e-book successfully creates a fun, engaging, and meaningful learning experience for early childhood learners. The development process followed a systematic series of stages, including needs analysis, content design and development, and validation by media and subject matter experts. Each stage was carefully designed to ensure that the e-book is not only visually and interactively appealing but also aligned with the cognitive and social developmental characteristics of young children. Expert validation confirmed that the e-book is suitable for use as an instructional medium. In addition to serving as a tool for introducing the concept of personal safety, it also makes a significant contribution to improving traffic safety literacy within early childhood education settings. By presenting content in a visual, narrative, and practical manner, the e-book not only enriches children's learning experiences but also strengthens teachers' understanding of the importance of integrating safety values into daily learning activities. Based on the results, it is recommended that early childhood educators utilize the e-book *"Let's Get to Know Traffic Signs"* as an interactive learning medium tailored to the developmental stages of young children. This e-book has the potential to become an effective educational tool that fosters a safe, responsive, and meaningful learning environment. Future researchers are encouraged to conduct broader and longer-term trials to evaluate the long-term impact of the e-book on children's behavioral changes related to traffic safety.

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