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Development of website-based BOGA SERI media to improve understanding safety riding principles

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ABSTRACT	ARTICLE INFO

The high number of traffic accidents that occur among teenagers, especially high school students, provides the background for the need to develop learning media that can improve their understanding of safety riding principles. Media development in the field of education is necessary because efforts to socialize these principles are considered ineffective, as evidenced by the high number of accidents in the regions. This study aims to produce and test the effectiveness of website-based BOGA SERI media in an effort to improve the understanding of these principles among grade X students of SMA Negeri 2 Tuban. The method used is research and development (RnD) with the ADDIE model. Data were collected through questionnaires, documentation, observation, and tests, and then analyzed using a parametric paired sample t-test. The results of statistical tests indicate that the website-based BOGA SERI media has a high level of validity and attractiveness, is easy to use for teachers, and is effective in enhancing students' understanding of safety riding principles. In conclusion, this media meets the criteria for feasibility and effectiveness and can be implemented as a learning medium to support efforts to maintain safety riding among students.

ABSTRAK

Tingginya angka kecelakaan lalu lintas yang terjadi pada remaja, khususnya murid SMA menjadi latar belakang perlunya pengembangan media pembelajaran yang mampu meningkatkan pemahaman prinsip safety riding. Pengembangan media dalam bidang pendidikan diperlukan karena upaya sosialisasi tentang prinsip tersebut dirasa kurang efektif, hal itu terbukti dari tingginya angka kecelakaan didaerah-daerah. Penelitian ini bertujuan menghasilkan dan menguji efektivitas media BOGA SERI berbasis website dalam upaya meningkatkan pemahaman prinsip tersebut pada murid kelas X SMA Negeri 2 Tuban. Metode yang digunakan adalah research and development (RnD) dengan model ADDIE. Data diperoleh melalui angket, dokumentasi, observasi, dan tes, kemudian data dianalisis menggunakan uji beda parametrik paired sample t-test. Hasil uji statistik menunjukkan bahwa media BOGA SERI berbasis website memiliki tingkat kevalidan dan kemenarikan yang sangat tinggi, mudah digunakan oleh guru, serta efektif dalam meningkatkan pemahaman murid mengenai prinsip safety riding. Kesimpulannya, media ini memenuhi kriteria kelayakan dan keefektifan serta dapat diimplementasikan sebagai media pembelajaran untuk mendukung upaya menjaga keselamatan berkendara pada kalangan pelajar.

Kata Kunci: BOGA SERI; media pembelajaran; prinsip safety riding; website

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INTRODUCTION

Traffic accidents remain a global concern, ranking among the leading causes of death worldwide. The Global Status Report on Road Safety 2018, published by the World Health Organization (WHO) (see: https://www.who.int/publications-detail-redirect/9789241565684), recorded approximately 1.35 million fatalities annually, making road traffic crashes the primary cause of death for individuals aged 5-29 years and the eighth leading cause of death across all age groups. In Indonesia, the Central Bureau of Statistics (BPS) (see: https://www.bps.go.id/id/statistics-table/2/NTEzlzl=/jumlah-kecelakaan--korban-mati--luka-berat--luka-ringan--dan-kerugian-materi.html) reported 139,258 traffic accidents in 2022, with 28,131 fatalities, the highest number occurring in East Java with 27,048 cases. A 2023 release by the Indonesian Ministry of Transportation further emphasized the persistently high rate of road accidents, underscoring the urgency of effective preventive measures.

Research has identified multiple factors contributing to traffic accidents, including the behavior of road users, the technical condition of vehicles, and environmental aspects such as road infrastructure and weather (Sadeghi & Goli, 2024). These three aspects are interconnected and jointly contribute to the overall risk of accidents, indicating that prevention efforts cannot be focused solely on one factor. In addition to technical and environmental aspects, several studies underline that human error is the predominant cause of traffic accidents. Negligence and risky riding behavior have a much greater impact compared to technical failures or environmental disturbances (Effendi et al., 2024). Low awareness of traffic rules is also identified as one of the primary triggers of accidents (Guritmaningsih et al., 2018). While weak public discipline on the road continues to dominate accident cases (Mubalus, 2023). Collectively, these findings indicate that improving infrastructure and vehicle quality alone is insufficient; increasing road user awareness and discipline must be a priority in reducing accident rates.

The lack of knowledge about safe riding is particularly concerning for adolescents aged 13 to 18. Previous research has shown that they tend to drive without an adequate understanding of safety riding principles. This leads to violations of regulations and traffic accidents (Pradnyadipta, 2020; Setyowati et al., 2024). This description is also supported by the results of other studies, which show that knowledge about riding safety principles influences a person's riding behavior (Hidayati & Hendrati, 2016). An alternative solution to minimize these incidents is to convey the principles of safety riding (Muryatma, 2018). These principles are also mandated in Undang-Undang Nomor 22 Tahun 2009 tentang Lalu Lintas dan Angkutan Jalan (see: https://peraturan.bpk.go.id/Download/27961/UU%20Nomor%2022%20Tahun%202009.pdf). Adolescents are frequently exposed to safety riding initiatives through school-based programs, such as socialization activities, internalization exercises, and the use of riding handbooks (Ayunaning & Prafitasiwi, 2022; Kuswanto et al., 2022; Siswanto et al., 2023). Nevertheless, the persistently high rate of traffic accidents suggests that these approaches have not been fully effective in instilling safe riding practices (Kumalasari et al., 2024). This situation has prompted the exploration of more engaging strategies, including the development of interactive learning media such as board games.

Previous studies have highlighted that board games offer distinct advantages over digital games, as they enable direct interaction among players, fostering familiarity, strengthening communication, and promoting social awareness (Fajarizka & Rizkiantono, 2016; Noda et al., 2019; Othman & Ching, 2024; Tangidy & Setiawan, 2017). These values are not only reflected during gameplay but are also aligned with the principles emphasized in Pancasila Education, particularly in building cooperation, mutual respect, and collective responsibility (Pramono et al., 2019; Rizanti & Jufri, 2023). Within the context of Pancasila Education, the topic 'Building a Culture of Law-abiding' in grade X is directly related to the principle of safe riding, as law-abiding behavior includes adhering to traffic regulations to minimize accidents. The Problem-Based Learning model, combined with the Role-Playing method, is often used in this context, as the

learning process begins with real-world problems, such as traffic violations that lead to accidents (Alfikrie et al., 2019). These approaches align with the learning objectives, which expect students to demonstrate law-abiding behavior in accordance with societal regulations (Djabarudin et al., 2025).

In response to this context, this study focuses on the development of Board Game Safety Riding (BOGA SERI). This website-based learning medium presents safety riding principles in a simple, engaging, and interactive manner. This contrasts with previous board game developments aimed at increasing traffic awareness that were not integrated into learning materials (Elianta et al., 2018). They were instead targeted outside the school environment (Kumalasari et al., 2024). They also had relatively simple components, resulting in inconsistent implementation because the targets were randomly or voluntarily selected, and knowledge about safety riding had not yet reached a high level due to the lack of question cards. Meanwhile, BOGA SERI was designed and developed with integration into Pancasila Education in schools, allowing for its consistent and widespread implementation. Furthermore, this medium has more complex components and is implemented through a problem-based learning model combined with role-playing methods, thus helping to acquire higher-level knowledge. This makes this game more relevant and practical to use.

Based on the description above, the research problem in this study is how to develop an effective website-based BOGA SERI media to improve students' understanding of safety riding principles and integrate them into Pancasila Education materials. This problem arises from the lack of interactive and contextual learning media, as conventional socialization methods have been less effective in engaging students. Therefore, it is essential to design innovative learning media that integrate educational content with interactive approaches to achieve improved learning outcomes.

Meanwhile, the purpose of this study is to develop and test the effectiveness of the website-based BOGA SERI media in improving high school students' understanding of safety riding principles integrated into Pancasila Education. This research also aims to provide alternative learning innovations that are more engaging, interactive, and relevant to students' real-life experiences. Furthermore, it is expected to encourage the cultivation of law-abiding behavior and stronger traffic discipline among adolescents.

LITERATURE REVIEW

Learning Media

Learning media are tools or objects used to convey messages from educators to students during learning activities. Their use can streamline classroom processes, improve efficiency, and enhance students' focus and engagement (Astuti, 2017; Lubis et al., 2023). Furthermore, learning media can be understood as any means employed to influence students' thoughts, feelings, and attention throughout the learning process (Zaini & Dewi, 2017). Based on these definitions, the presence of learning media is essential to support the teaching and learning process, enabling the achievement of predetermined educational objectives.

Furthermore, learning media serve a fundamental function as tools that support the teaching and learning process by shaping the atmosphere, conditions, and environment created and managed by educators (Kustyarini et al., 2020). Among various types, visual-based media are often employed because of their effectiveness in engaging students. Such media perform several essential functions, including capturing attention, fostering positive attitudes, enriching knowledge, and providing complementary support to the learning process (Maxmudova et al., 2024). Beyond these functions, learning media also offer important benefits: they help convey information or messages more clearly, enhance and focus students' attention, overcome sensory, spatial, and temporal limitations, provide shared experiences related to real-world events, assist educators in delivering stimuli and experiences, and create comparable learning experiences (Firmadani, 2020; Zahwa & Syafi'i, 2022).

Board Game

Board games are games whose main component is a thick board, with supporting components such as cards, pawns, dice, coins, and other elements. These games are equipped with themes and rules that encourage interaction between players (Jordi, 2017; Tangidy & Setiawan, 2017). Board games are entertaining and usually played in groups, while also fostering competitive, cooperative, and collaborative behaviors that are important for the future (Andrew & Muladi, 2021; Nurfaidzah et al., 2021). In addition to fostering positive behaviors, board games also contribute to the development of problem-solving skills, strategy formulation, creativity, and critical thinking (Setyanugrah & Setyadi, 2017). As educational tools, board games can help address learning challenges by increasing motivation, stimulating growth and development, enhancing cognitive abilities, and improving children's learning outcomes (Kurniawan et al., 2021). Therefore, board games can serve as an effective learning medium that allows educators to convey material persuasively, making it easier to understand and helping to resolve learning difficulties.

The definition of board games has been explained clearly, and further descriptions relate to their types, which include strategy-based games, German-style games, speed-based games, roll-based games without a finish line, trivia-based games, word-based games, and battle-based games (Mufida & Abidin, 2021). The advantages of board games as a learning medium include creating a warm and enjoyable atmosphere, offering various types of play, being suitable for all groups, providing educational value, being fun and engaging, as well as helping to increase knowledge, facilitating an understanding of learning material, and motivating students (Cahyaningtyastuti, 2020). However, board games in learning also have disadvantages such as high variation in research designs making it difficult to conclude general effectiveness, requiring more time to introduce the rules especially for students who are not familiar with them, potential cognitive overload if the rules are too complex or not well explained, and challenges in implementing them at scale to ensure widespread access and dissemination (Huang et al., 2022; Sousa et al., 2023).

Safety Riding Principles

Safe riding is a condition in which a person behaves correctly while riding a motorcycle. This includes using and paying attention to riding equipment as well as maintaining the vehicle's condition. By doing so, riders can minimize the risk of accidents (Hadma, 2022; Haryanto, 2016). Furthermore, safe riding is a person's effort to avoid traffic accidents caused by several factors, including human error, vehicle malfunction, road conditions, and the surrounding environment (Bęczkowska & Grabarek, 2021).

Efforts to avoid accidents can be made by applying the principles of safe riding, which consist of driver condition, vehicle condition, traffic signs, concentration, and safety equipment. The principle of driver condition refers to the rider's optimal physical condition, which helps avoid the influence of alcohol, illegal drugs, and fatigue (Camelia et al., 2024; Widiyatmoko et al., 2023). The principle of vehicle condition relates to the proper functioning of motorcycle components, including brakes, clutch, throttle, cables, tire pressure, lights and turn signals, horn, mirrors, fuel and oil, and the chain. The principle of traffic signs concerns the rider's attention to road signs, such as no parking, no left or right turns, no U-turns, speed limits, and sharp turns. The principle of concentration emphasizes the rider's focus while on the road. In contrast, the principle of safety equipment refers to the protective tools used by motorcyclists, including helmets, face and eye protection, protective clothing, gloves, and shoes, as explained by Kementerian Perhubungan in its official report on traffic accidents being the third leading cause of death (See: https://dephub.go.id/post/read/kecelakaan-lalu-lintas-tempati-urutan-tiga-penyebab-kematian-5131).

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Problem-Based Learning

The problem-based learning model is a learning approach based on the constructivist concept, where students are presented with everyday life problems and asked to analyze and formulate solutions (Ernawati, 2017; Hendriana et al., 2018; Meilasari & Yelianti, 2020; Yuliasari, 2023). Based on these opinions, it can be concluded that problem-based learning is a learning model characterized by the presentation of problems during the learning process and the requirement for students to analyze and formulate solutions to these problems.

In the process of assessing problems in the learning process, this model has the benefit of teaching students to improve their knowledge, skills, and self-confidence (Safitri et al., 2024). Meanwhile, other opinions suggest that the problem-based learning model can foster students' inquiry skills and problem-solving abilities by providing experiences and increasing self-confidence when thinking, ultimately shaping students into independent individuals (Sari, 2019; Wardani & Fiorintina, 2023). Referring to the previous description, it can be said that the problem-based learning model has various benefits for students and is suitable for implementation.

On the other hand, the problem-based learning model has both advantages and disadvantages. The advantages of this model include stimulating student motivation and learning activity, encouraging students to share and develop knowledge, improving their critical thinking skills, and helping them apply concepts and learning materials in practice (Hotimah, 2020; Widyasari et al., 2024). However, the disadvantages emerge when student interest wanes during the learning process, which often causes them to become reluctant to continue learning and sometimes leads them to feel that they do not need to provide solutions to the problems presented (Hotimah, 2020).

Role Playing

Role-playing is a learning method implemented by presenting roles from social life and deliberately displaying them in class (Halidu & Etango, 2021). Role-playing can encourage students to express their feelings and awareness through direct involvement in analyzing real-life problems (Sogen, 2025). Role-playing also fosters learning experiences that include collaboration, communication, and expressing opinions about events from various perspectives, thereby making the learning process active, creative, and interactive (Najjemba & Cronjé, 2020). It is not surprising that this method helps students easily understand and master the subject matter.

The role-playing learning method is characterized by the involvement of more than one individual, collaboration among students to achieve learning objectives, opportunities for students to play roles based on a given scenario, and equal chances for all students to participate and demonstrate their abilities (Naldi et al., 2024; Sari et al., 2023). Beyond these characteristics, this method offers several advantages in the classroom, including enabling students to practice, understand, and retain learning material through dramatization, fostering activity, creativity, and innovation, encouraging collaborative work, promoting peer responsibility-sharing, and developing communication skills while providing meaningful new experiences. However, the role-playing method also has limitations, including the need for considerable time allocation, the requirement of a relatively large space, and the potential to disrupt the concentration of other classes due to noise from conversations or applause (Naldi et al., 2024; Qin et al., 2024).

METHODS

This study employed a Research and Development (R&D) approach, utilizing the ADDIE model, which comprises five systematic stages: analysis, design, development, implementation, and evaluation. Branch

explains the five stages in his book "*Instructional Design: The ADDIE Approach*", which provides a structured framework for developing and evaluating learning media. The ADDIE model was chosen due to its systematic nature. However, this study made several modifications to adapt it to the context of board game development, particularly by emphasizing product validation and testing during the design and development stages. These modifications were necessary to ensure product feasibility before implementation.

The analysis phase included a needs assessment related to students' understanding of safety riding principles, student characteristics, available learning facilities, and suitable learning strategies. The design and development phase involved creating game boards, components, guidebooks, simulation videos, and a website. Validation by media and materials experts, followed by product trials, was conducted to refine the prototype. The implementation phase was conducted on grade 10 students of SMA Negeri 2 Tuban. In contrast, the evaluation phase was based on expert validation, student and teacher responses, as well as product effectiveness testing.

The population in this study consisted of 325 students from Grade X of SMA Negeri 2 Tuban, thus requiring a representative sample. The sampling technique used was cluster random sampling because the population was grouped and relatively large. The group in this study consisted of grade X students from nine classes (A through I). A small group sample of 10 students and a large group sample of 25 students were selected, following the R&D standard of approximately 10% of the population, or 33 students in this case. Accordingly, the small group sample consisted of one to two students per class, while the large group sample consisted of two to three students per class.

The data used in this study were both qualitative and quantitative. Qualitative data were derived from respondents' suggestions and input, while quantitative data were obtained from the results of the questionnaire. Data collection techniques included questionnaires, documentation, observation, and tests. Documentation in the form of notes, pictures, and copies of documents was also applied as an important supporting technique in collecting research data. Observations were conducted during pre-research activities, and tests (including a pretest and posttest) were carried out to evaluate the product's effectiveness. The instruments used included validation sheets for media experts and material experts, student and teacher response sheets, as well as pretest and posttest questions.

The research stages included media validity testing, validity and reliability testing of the question instrument based on the Traffic Law, and trials with both small and large groups. Data analysis techniques involved comparing student scores with the KKTP (Learning Objective Completion Criteria) to determine the validity of the instrument. Reliability was tested using the Cronbach alpha formula. The Kolmogorov-Smirnov and Shapiro-Wilk tests, using SPSS 25.0 for Windows, were employed to assess the normality of the data. Furthermore, a paired sample t-test was applied to determine the effectiveness of the developed learning media.

RESULTS AND DISCUSSION

Development of Website-Based BOGA SERI Media to Improve Understanding of Safety Riding Principles

The website-based BOGA SERI media was developed using the ADDIE model, which involves analyzing, designing, developing, implementing, and evaluating, resulting in valid, engaging, and effective website-based BOGA SERI media. The following is a further description of the stages of website-based BOGA SERI media development.

Analyze

During the analysis phase, researchers distributed questionnaires via Google Forms and collected data on the problems faced by tenth-grade students. 83.9% did not have a driver's license (SIM), while 16.1% did. Despite this, they are aware of the importance of a driver's license, and most of them use motorcycles to get to and from school. Furthermore, 100% of students agreed that their school does not yet have a platform to communicate the principles of safe riding.
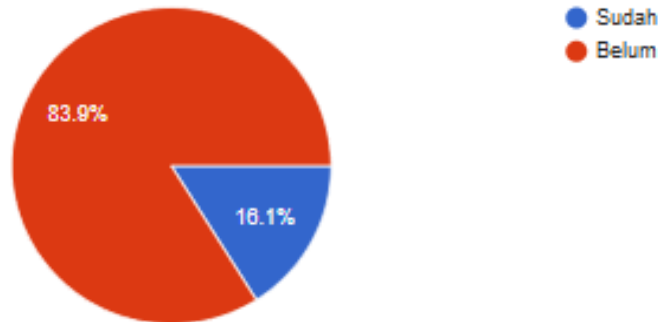

Figure 1. Student Driver's License Ownership Data
Source: Author's Documentation, 2025

Figure 1 presents a diagram of riding license ownership among class X students. The data indicate that these students generally do not yet possess a riding license. The reasons include not being old enough, not having an ID card, and not having had the opportunity to apply for a riding license.

Figure 2. Class X Student Parking Area
Source: Author's Documentation, 2025

Figure 2 illustrates that various motorcycle brands, including Vario, Scoopy, Beat, Mio, Vespa, and others, occupy the 10th-grade parking lot. The presence of these vehicles indicates that many students use motorcycles as their primary means of transportation to school. This condition is concerning because the students are underage and legally not permitted to ride motorcycles.

In connection with these findings on student behavior outside the classroom, further data were obtained regarding student characteristics during the learning process. Tenth-grade students tend to rely on rote learning methods, which often lead to boredom in Pancasila Education lessons and create a less conducive classroom environment. To better understand the context of learning, additional data were also collected regarding supporting resources and strategies. At SMA Negeri 2 Tuban, supporting learning resources include LCDs, projectors, Wi-Fi, and sound systems in each classroom, and students are allowed to bring cell phones to support learning activities. However, despite the availability of these facilities, the learning strategies used remain dominated by lectures and memorization.

Design

The design phase encompassed the development of several key elements, including the game board, game components, manual, game simulation video, and website. Each element was initially created using accessible tools and materials to ensure practicality and feasibility. The game board was designed with illustrated patterns of roads, buildings, and traffic signs. The game components, such as various cards, were developed by formulating their contents. Other items, including the traffic light ball, speed dice, and judge and prosecutor pawns, were procured from available sources. The manual was prepared by drafting the content to be explained, and the same approach was applied to the development of the game simulation video and website.

Development

The development was carried out on several objects, namely: The game board was developed using the Photoshop application. The game board image will be printed using 80 x 55 centimeter Ritrama sticker paper, and underneath it will be covered with cardboard to ensure it is strong and durable. The following is a display of the printed board game.

Figure 3. Display of *Board Game*
Source: Author's Documentation, 2025

Figure 3 displays a printed board game ready for testing. Game components, including riding equipment cards, violation information cards, traffic sign cards, and ticket cards, were developed using the Canva application. Then, they were printed on 9.8 x 6.8 centimeter-sized glossy ivory paper, weighing 25 grams. Meanwhile, other game components, including traffic light balls, speed dice, judge pawns, prosecutor pawns, and driver pawns, were available because they were obtained from one of the online shops or offline stores in Malang City. The guidebook was developed using the Canva application. After the process is complete, the guidebook will be uploaded to the website. The game simulation video was developed using Adobe Audition, a video editing application, by a video editing expert. The improved video will be uploaded to the YouTube page, and the link will be available on the website. Experts in their fields developed the website based on the researcher's design. Students can easily access the BOGA SERI website through the link https://boga-seri.codesdev.my.id/.
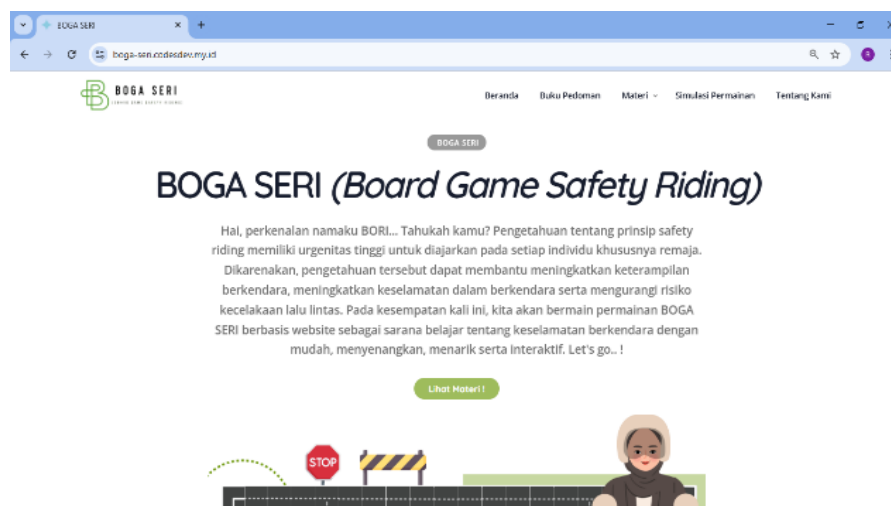

Figure 4. Front Page (Dashboard) Website BOGA SERI
Source: Author's Documentation 2025

Figure 4 shows the front page (dashboard) of the BOGA SERI website, which students will encounter when they first access the website link. Once the website-based BOGA SERI media is complete, its validity must be tested by media and materials experts. This is done to measure the level of validity and provide a basis for improving and refining the developed learning media. Following the initial appearance of the website, as shown in **Figure 4**, the results of the validity test for the media and materials developed are presented in **Table 1**.

Table 1. Recapitulation of Expert Validation Result

No.	Description	Percentage	Criteria
1.	Media Expert Validation	96,6%	Very Valid
2.	Material Expert Validation	88,3%	Very Valid
	Average	**93,8%**	**Very Valid**

Source: Researcher Processed Data, 2025

Table 1 recapitulates the expert validation results. Based on these validation results, it can be concluded that the website-based BOGA SERI media meets the validity requirements in terms of media and material. This was also confirmed based on suggestions and criticisms from media experts, who stated that the media was good and could be tested, but needed improvements in the packaging and website appearance. Furthermore, the results of the questionnaire responses from field experts (teachers)

regarding the use of the media in small groups were also presented. This was used to determine the practicality of the media. The results of the questionnaire responses from field experts (teachers) for the small-group trial are listed in **Table 2**.

Table 2. Result of the Practicality Test Obtained from the Teacher Response Questionnaire

No.	Aspect	Presentage	Criteria
1.	Media Design	100%	Very Practical
2.	Media Usage	95%	Very Practical
3.	Material Presentation	90%	Very Practical
4.	Media Benefit	100%	Very Practical
	Average	**95%**	**Very Practical**

Source: Researcher Processed Data, 2025

Table 2 shows the results of the practicality test obtained from the teacher response questionnaire. Based on this table, it can be concluded that the website-based BOGA SERI media is efficient, achieving an average score of 95%. Therefore, it can be used for Pancasila Education learning in the classroom.

After testing the validity and practicality of the media and materials, validity and reliability tests were conducted on the question instrument (pretest and posttest) administered to 9 students, as well as to small and large groups. In the validity test, the question instrument obtained a validity result of 100% because nine students obtained a score of ≥ 61, which is the minimum limit in the KKTP. Meanwhile, the reliability test of the question instrument yielded a result of 0.87, indicating that it can be classified as reliable.

Implementation

Next, the implementation stages of the website-based BOGA SERI media, based on the teaching module that has been created, are as follows. First, the initial learning activity is conducted for 10 minutes, consisting of several stages, namely, students respond to the teacher's greeting, students pray according to their respective religions or beliefs, students' attendance is checked, they are asked questions related to their situation during the lesson, and students are asked to understand the learning objectives. Second, the core learning activity is conducted for 100 minutes, adapted to the problem-based learning model and role-playing method, using PowerPoint and the website-based BOGA SERI media. The following stages (learning syntax) were carried out in the core activity, namely orienting students to the problem, organizing students for learning, guiding individual or group investigations, developing and presenting work, and analyzing and evaluating the problem-solving process. Third, the closing activity of the learning is carried out for approximately 10 minutes, which consists of several stages. These stages include students and teachers concluding the material that has been studied, the teacher providing motivation and messages to the students, and students, together with the teacher, ending the learning activity by praying.

Evaluation

After the implementation stage was completed, the process continued with the evaluation phase, which involved revising the website-based BOGA SERI media. The first revision was made based on suggestions and comments from media experts, while the second revision was carried out following feedback from small-group trials. These revisions were used to refine and improve the quality of the media.

Effectiveness of the BOGA SERI Website-Based Media Implementation to Improve Understanding of Safety Riding Principles

The BOGA SERI website-based media implementation was conducted in a large-group trial with 25 students. The large-group trial was used to determine the appeal and effectiveness of the BOGA SERI media. The media's appeal can be seen from the results of the student questionnaire responses in the large group, as shown in the following table:

Table 3. The Results of the Student Response Questionnaire

No.	Aspect	Percentage	Criteria
1.	Media Appeal	93,6%	Very Interesting
2.	Media Clarity	95%	Very Interesting
3.	Learning Media Content	93,6%	Very Interesting
4.	Media Easey for Use	93%	Very Interesting
	Average	**93,8%**	**Very Interesting**

Source: Researcher Processed Data, 2025

Table 3 presents the results of the student response questionnaire. The table shows that the website-based BOGA SERI media is highly engaging, achieving a score of 93.8%, making it suitable for use in classroom instruction under Pancasila Education. This was also confirmed by student suggestions and criticisms, who stated that the media was engaging but would be better if the questions were more varied.

The effectiveness of the website-based BOGA SERI media is evident from the post-test results of students in large groups. Pretest and posttest scores were subjected to paired sample t-tests. This test was conducted to determine whether there were differences between the pretest and posttest. However, before conducting the paired sample t-test, a Shapiro-Wilk test was first performed. This test was conducted to determine whether the collected data were normally distributed. The results of the Shapiro-Wilk test showed a significance value of 0.150 for the pretest and 0.093 for the posttest. Based on the pretest significance values, it can be concluded that the data were normally distributed. This is indicated by a pretest significance of 0.150 > 0.05 and a posttest significance of 0.093 > 0.05. When the data is normally distributed, a paired t-test can be carried out as follows in **Table 4**.

Table 4. Result of the Paired Sample t-test

		Paired Samples Test								
		Paired Differences					t	df	**Significance**	
					95% Confidence Interval of the Difference				One-Sided p	Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper				
Pair 1	Pretest - Posttest	-7,36000	5,00733	1,00147	-9,42692	-5,29308	-7,349	24	0,000	0,000

Source: Researcher-Processed Data, 2025

Table 4 shows the results of the paired sample t-test. The table above shows a Sig value of 0.000, indicating that Sig < 0.05. This indicates a difference between the pretest and posttest results. This difference suggests that the use of website-based BOGA SERI media can enhance students' understanding of safety riding principles.

Discussion

The development research conducted resulted in a website-based game media that demonstrated significant effectiveness in improving students' understanding of safety riding principles. The paired sample t-test results on pretest and posttest scores showed a substantial increase in students' comprehension, supporting the theoretical foundation that learning media serve as essential tools to enhance efficiency and student engagement (Astuti, 2017; Lubis et al., 2023). This improvement aligns with the fundamental function of learning media as described in the literature, where visual-based media effectively capture attention, foster positive attitudes, and enrich knowledge (Maxmudova et al., 2024). Further findings indicated the formation and reinforcement of law-abiding attitudes aligned with the values in Pancasila Education learning, demonstrating that this media can be used for specific materials while increasing efficiency, effectiveness, and enhancing student concentration (Lubis et al., 2023). Furthermore, this media is considered relevant for Pancasila Education learning because it emphasizes the formation and reinforcement of national attitudes, such as obeying regulations (Wahyuni, 2024).

Game media was chosen based on Edgar Dale's cone of experience theory, which posits that media that include direct experience, purposeful experience, and simulated experience represent the most concrete or practical media to use (Sari, 2019). This theoretical foundation is further supported by the board game literature, which demonstrates that board games serve as practical educational tools by addressing learning challenges through increased motivation, stimulated growth and development, enhanced intelligence, and improved learning abilities (Kurniawan et al., 2021). The practicality test conducted confirmed this theoretical basis, showing that the media has a high level of practicality when used in learning. The media's effectiveness can be attributed to its alignment with board game characteristics that foster competitive, cooperative, and collaborative behaviors important for future development (Andrew & Muladi, 2021; Nurfaidzah et al., 2021). Furthermore, this media is practical because it aligns with the desired goals in Pancasila Education learning in the modern era: students can construct their own knowledge by investigating and solving problems, increasing self-confidence when thinking, and forming independent learning (Sari, 2019; Wardani & Fiorintina, 2023).

The game media developed in this study, called BOGA SERI (Board Game Safety Riding), represents a website-based medium integrated with the material "Building a Culture of Obedience to the Law," which presents safety riding principles in a simple, engaging, and interactive manner. This integration addresses the theoretical gap identified in learning media literature, where media should provide shared experiences related to real-world events and assist educators in delivering stimuli and experiences (Firmadani, 2020; Zahwa & Syafi'i, 2022). Previous studies developed similar media (Elianta et al., 2018; Kumalasari et al., 2024) with different objectives, namely increasing traffic awareness. However, these studies did not integrate the media into learning materials, and their implementation was less consistent because the target participants were randomly selected or voluntarily enrolled grade X high school students. Thus, the developed media differ from previously existing media in terms of their objectives and the integration of learning media with systematic learning processes.

The website-based BOGA SERI media game combines reel-based (no finish line) and speed-based board games, reflecting the theoretical classification of board game types described in the literature (Mufida & Abidin, 2021). This design choice leverages the advantages of board games as a learning medium, including creating a warm and enjoyable atmosphere, offering various types of play, being suitable for all groups, providing educational value, and facilitating an understanding of the learning material (Cahyaningtyastuti, 2020). This contrasts with board games developed by other researchers, which typically utilize a single game platform, such as the trivia-based Batula board game, which presents numerous questions and requires players to answer them (Anindita & Pratama, 2024). Other researchers have developed a board game based on the traditional stilt game for elementary school students, which uses a speed-based approach similar to Ludo (Rizqiyani et al., 2025).

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The website-based BOGA SERI media employs a problem-based learning model and role-playing methods, directly implementing the theoretical frameworks outlined in the literature review. The problem-based learning model, grounded in constructivist theory, presents students with everyday life problems and requires them to analyze and formulate solutions (Ernawati, 2017; Hendriana et al., 2018; Meilasari & Yelianti, 2020; Yuliasari, 2023). This approach has facilitated student participation in solving contextual problems around them, as the literature demonstrates that this model encourages students to develop inquiry skills, problem-solving abilities, and independent thinking (Sari, 2019; Wardani & Fiorintina, 2023). The problem faced by high school students in Indonesia, namely the high number of traffic violations leading to accidents, aligns perfectly with the problem-based learning framework. Students at SMA Negeri 2 Tuban committed violations by not having driver's licenses and not wearing riding equipment, resulting in accidents and deaths, requiring immediate action through increased understanding of safety riding principles.

The implementation of the role-playing method follows a theoretical foundation that encourages students to express their feelings and awareness through direct involvement in analyzing real-life problems (Sogen, 2025). The method's characteristics, which involve multiple individuals, promote collaboration and provide equal participation opportunities, are fully realized in the BOGA SERI implementation (Naldi et al., 2024; Sari et al., 2023). Furthermore, the role-playing method has demonstrated its effectiveness in encouraging students to demonstrate awareness in analyzing real-world problems, such as traffic accidents, through direct involvement (Alfikrie et al., 2019; Ningsih, 2019). This theoretical application aligns perfectly with Pancasila Education learning objectives in the relevant material.

The website-based BOGA SERI media's effectiveness in improving understanding of safety riding principles as a solution to address high traffic accident rates is supported by both cognitive theory and board game literature. Cognitive theory suggests that games enhance understanding through active engagement and problem-solving. Board game research demonstrates their capacity to enhance problem-solving skills and develop strategy formulation, creativity, and critical thinking (Seftriyana & Megasari, 2025; Setyanugrah & Setyadi, 2017). This finding aligns with research from other sources, which shows that board games can help increase traffic awareness (Elianta et al., 2018; Kumalasari et al., 2024). The theoretical foundation is further strengthened by previous research demonstrating that board games can improve problem-solving skills in thematic learning contexts and enhance critical and creative thinking skills (Safitri, 2020; Tsani & Saputra, 2021; Widiyanto & Yunianta, 2021).

The website-based BOGA SERI media enables teachers to create engaging, enjoyable, challenging, effective, and innovative learning, particularly in "Building a Culture of Law-abidingness." This capability reflects the theoretical understanding that learning media should convey information clearly, enhance student attention, overcome various limitations, and provide shared experiences (Firmadani, 2020; Zahwa & Syafi'i, 2022). This media supports efforts to educate the younger generation through meaningful, experiential learning and can serve as a reference in formulating educational policies for high school students related to factual and contextual experiential learning. The comprehensive components of the website-based BOGA SERI media including traffic lights, speed dice, riding equipment cards, violation information cards, traffic sign cards, ticket cards, various pawns, game guidebook, and safety riding materials demonstrate the theoretical principle that effective board games require supporting components such as cards, pawns, dice, and other elements with themes and rules that encourage player interaction (Jordi, 2017; Tangidy & Setiawan, 2017). These components are more numerous and complex compared to other traffic board games from previous researchers, which typically include driver pawns, cards, dice, road boards, signs, coins, and guidebooks (Elianta et al., 2018; Kumalasari et al., 2024). The complexity aligns with the theoretical understanding that comprehensive components enhance effectiveness in achieving learning objectives while maintaining the advantages of board games as educational tools.

The safety riding material presentation, delivered through PowerPoint and infographics, reflects the theoretical foundation that effective learning media should convey messages clearly and engage students without causing boredom. Research supports the notion that PowerPoint serves as an effective means of delivering learning materials while maintaining student interest and enthusiasm (Dewi & Izzati, 2020; Rosyiddin et al., 2023; Supit, 2021). This approach addresses the limitation identified in previous research where detailed e-book formats, despite being clear and comprehensive, raised concerns about student boredom during study sessions. The ADDIE model (Analysis, Design, Development, Implementation, Evaluation) is implemented in developing the BOGA SERI website-based media, following established instructional design principles while incorporating the theoretical frameworks of problem-based learning and role-playing methods. Each stage systematically integrated learning media theory, board game principles, and pedagogical approaches to create a comprehensive educational tool.

This research makes a significant contribution to the theoretical understanding of integrating board game principles with problem-based learning and role-playing methods in Pancasila Education contexts. However, several limitations align with the theoretical disadvantages of board games mentioned in the literature, including the emphasis on visual learning styles, which may not accommodate students with different learning preferences. The literature identifies that board games may require more time for rule introduction and can present challenges in large-scale implementation (Huang et al., 2022; Sousa et al., 2023). Furthermore, the media was developed specifically for "Building a Culture of Law-abidingness," requiring similar development for other Pancasila Education topics. The relatively limited sample size of 25 students for large group trials also reflects the implementation challenges identified in board game literature. Future research should address these theoretical limitations while building upon the demonstrated effectiveness of integrating multiple pedagogical approaches in board game-based learning media.

CONCLUSION

The BOGA SERI website-based media, integrated with the Building a Culture of Law-abidingness material in Pancasila Education learning for grade X, has been successfully developed by referring to the ADDIE model, which includes analysis, design, development, implementation, and evaluation stages. The results of expert validation indicate that the media is categorized as very valid in both terms of content and material. Trials conducted in both small and large groups suggest that the media is an exciting and practical tool to use in the learning process. In addition, effectiveness testing demonstrates that this media can significantly improve students' understanding of safety riding principles and also strengthen their law-abiding attitudes in accordance with the values of Pancasila. These findings align with the research problem and objectives, specifically to develop innovative learning media that are not only interactive and contextual but also effective in supporting the achievement of learning outcomes and character formation among high school students.

This research, however, has limitations because it focuses solely on the development of media for the 'Building a Culture of Law-abidingness' topic and involves a relatively small number of students in the trial. Therefore, future research is recommended to expand the use of BOGA SERI to other Pancasila Education topics and involve a larger and more diverse group of participants to ensure broader applicability. Moreover, further studies are encouraged to adapt the media to different learning styles, including kinesthetic approaches, so that the effectiveness of the media can be maximized and support a more inclusive learning process.

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