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Development of QR code-based interactive ludo learning media for teaching Pancasila values to fourth grade students

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Abstract: This study aims to develop a product in the form of an application as a learning medium, namely the Interactive Ludo Learning Media Based on QR Codes for Teaching the Application of Pancasila Values, which is both valid and practical. The research employed a Research and Development (R&D) approach using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The study was conducted at SDN 1 Kedungrejo and SDN 2 Kedungrejo with fourth-grade students as the subjects. Data were collected through observations, interviews, and questionnaires. The instruments used were student response questionnaires and questionnaires assessing student and teacher needs. The results of the validity test of the QR Code-based learning media reached an average score of 92%, categorised as very valid, while the practicality test yielded an average score of 94%, indicating a very practical level. Therefore, it can be concluded that the study successfully developed Interactive Ludo Learning Media Based on QR Codes for the Application of Pancasila values among fourth-grade elementary school students, which met the standards of validity and practicality.

Keywords: learning media, interactive ludo, Pancasila education, application of Pancasila values

Introduction

As stated in Law No. 20 of 2003 of the Republic of Indonesia, learning is defined as an interactive process between students, teachers, and learning resources within a learning environment. Various supporting components are required to facilitate the learning process and achieve the intended objectives. These components include learning objectives, teaching materials, instructional approaches, methods, strategies, media, tools, and evaluation methods for both students and teachers. Effective learning requires students to actively participate to improve their learning outcomes. One subject that can be applied to promote active participation is Pancasila Education.

Pancasila and Civic Education are not merely subjects but also a form of education that helps build the totality of citizens capable of actively participating in social and civic activities, as seen in schools, communities, social organisations, and mass media (Telaumbanua, 2019). To achieve successful education, the learning process can be implemented efficiently when teachers fulfil their function as facilitators who create an engaging learning atmosphere using teaching materials that attract students' attention throughout the learning process (Buchari, 2018).

In addition to a conducive environment, the success of classroom learning is also determined by how teachers conduct the teaching process. The effectiveness of teaching and learning in the classroom is highly influenced by teachers' creativity. Teachers have a major influence on students' learning abilities. By utilising various learning media, a more diverse and engaging learning process can be achieved. However, at SDN 1 Kedungrejo, the use of learning media has not yet been optimised.

Based on observations and interviews conducted with teachers on Thursday, January 20, 2024, in two schools in Kedungrejo Village that is SDN 1 Kedungrejo and SDN 2 Kedungrejo, several problems were identified in the teaching of Pancasila Education: (1) The available learning media are limited and only consist of images; (2) Students have difficulty understanding the material on the application of Pancasila values; (3) Teachers still predominantly use lecture methods, which do not actively involve students in the learning process; and (4) There are limited facilities for using IT. Due to these limitations in media and technology use, teachers require support in developing a game-based learning medium with attractive design elements. This development aims to increase students' interest and facilitate their understanding of the application of Pancasila values.

Based on the above explanation, this need arises from the lack of teachers' creativity and initiative in delivering the material, as well as the absence of learning media that can help teachers explain the application of Pancasila values in daily life in an engaging manner. During the learning process, teachers merely provide examples of Pancasila values and general descriptions of attitudes to be practised in everyday life. Meanwhile, students tend to listen passively without engaging in interactive learning. Therefore, learning media are needed to make the learning process more practical and interesting. In the classroom, media function as tools used by teachers to convey material to students. Without appropriate media, learning materials, especially those that are complex and abstract, will be difficult for students to understand (Suwarni, 2020). Concrete media can be effectively applied by adapting traditional games to preserve local culture, such as the Ludo game.

The idea of developing Ludo as a medium for teaching the application of Pancasila values in Pancasila Education arises because the game itself is enjoyable for children, especially those in elementary school. According to Ningsih and Pritandhari (2019), Ludo media serve as tools that assist the learning process by acting as intermediaries between teachers and students. Teachers also recognise that without the use of media, students find it difficult to understand the material, particularly topics that are abstract or complex. Previous studies have also developed Ludo-based learning media, including

Iswara (2020) on multiplication and division materials, Ristanti (2020) on cultural diversity materials, and Rahmawati (2019). All four studies concluded that Ludo-based media were highly effective, practical, engaging, and feasible for use as instructional tools in schools.

Based on previous studies, it is known that there has been no interactive Ludo medium utilising QR Codes for fourth-grade students to learn the application of Pancasila values in Pancasila Education. Therefore, the researcher was interested in developing an updated Ludo medium for the fourth-grade Pancasila Education subject, namely an Interactive Ludo Learning Media Based on QR Codes. This media represents a playful learning approach, containing important notes corresponding to the provided images. It is suitable for fourth-grade students at SDN 1 Kedungrejo, who tend to have a low interest in reading, and can be used flexibly in various learning contexts. Furthermore, this Ludo medium is equipped with question cards, material cards, challenge cards, and bonus cards, which include QR Codes linked to prearranged videos containing explanations and related questions. The QR Codes can be scanned using a laptop camera connected to an LCD projector. Through this feature, students can become more engaged, and the learning process becomes more effective and enjoyable.

In this study, the theoretical underpinnings for the creation of Ludo-based learning media for Pancasila Education are elucidated through three theoretical frameworks: grand theory, meso theory, and applied theory, each of which thoroughly endorses the design and execution of the learning media.

Transformative Learning Theory, proposed by Mezirow (1991), serves as the overarching theory that supports this research. This theory emphasises learning as a process that encompasses the acquisition of knowledge and engenders a profound transformation in perspective and comprehension. This theory is especially relevant in the context of Pancasila Education as it facilitates students' theoretical understanding of Pancasila values while also encouraging them to reflect on and internalise these values in their daily lives. Transformative learning requires students to participate critically and actively, which is why the Ludo-based learning media created in this study is an effective way to help them change their perspective.

Bandura's (2001) Social Cognitive Theory offers a significant viewpoint on individual learning within social contexts. This theory emphasises the significance of social interaction and behavioural modelling in the learning process. Teachers in the classroom are not just sources of information; they are also role models who give students direct examples to follow. For Pancasila Education, media such as the interactive Ludo game with QR codes enable students to learn by watching and interacting with each other, as well as by applying Pancasila values in their own lives. This aligns with social cognitive theory, which posits that learning is most effective when individuals observe others and engage with the social world.

The research employs Constructivist Learning Theory, based on the foundational theories of Piaget and Vygotsky (1978). This theory posits that learning is an active process wherein students construct knowledge through engagement with their environment and peers. The creation of Interactive Ludo Learning Media aligns with constructivist ideas, as it encourages students to engage in hands-on, problem-solving activities that facilitate deeper learning. Adding QR codes to the Ludo game enables students to interact with digital content, supporting a constructivist approach that views learning as an active process of making meaning. This applied theory emphasises the significance of context and active participation in learning, both of which are fundamental to the design of the interactive media in this study.

This study fills a void in the existing literature. Although prior research has examined Ludo-based learning media in diverse educational contexts (Iswara, 2020; Ristanti, 2020), the incorporation of QR codes to augment interactivity in Pancasila Education remains insufficiently investigated, especially concerning fourth-grade students. The

uniqueness of this study resides in its amalgamation of QR codes with conventional learning media, presenting a novel methodology for imparting abstract concepts, including Pancasila values. This research addresses the deficiency in utilising technology to foster an engaging and effective learning experience for Pancasila Education by integrating multimedia elements via QR codes.

Method

This research employed the Research and Development (R&D) model of ADDIE, which stands for Analysis, Design, Development, Implementation, and Evaluation, as stated by Sugiyono (2011, P. 407). This model applies systematic and structured stages to achieve the expected results (Wulandari, 2018). The concept of the ADDIE model establishes the fundamental framework for learning, specifically the development of a learning product design. The research subjects in this study were fourth-grade students of SD Negeri 1 Kedungrejo, an elementary school located in Malang Regency, East Java, with a total of 32 students.

This development model consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation. The analysis stage involved collecting data through observation and interviews to identify needs. The design stage involved creating and planning the product design and assessing it through evaluation by the parties involved, including media experts, material experts, and users. The development stage involved creating the product that had been previously designed, which was the Interactive Ludo Learning Media Based on QR Codes. This medium consisted of a game banner, material cards, question cards, bonus cards, challenge cards, a guidebook, dice, and tokens, which were represented by the students. The implementation stage involved applying the product to a small group of eight fourth-grade students at SDN 1 Kedungrejo and subsequently to a larger group of 32 students in the same grade at the same school. The evaluation stage was conducted to assess the success of developing the Interactive Ludo Learning Media Based on QR Codes, which applied the values of Pancasila in the material.

The techniques used for data collection included observation, questionnaires, interviews, and documentation. These types of data were used to support the creation of the Interactive Ludo Learning Media Based on QR Codes for the material on the application of Pancasila values. Quantitative data were in the form of numerical values obtained from validation tests conducted by media experts, material experts, teachers, and students, who served as users. Meanwhile, qualitative data were obtained from interviews. The quantitative data obtained using the Likert scale were interpreted in percentage form using the following formula.

$$Vah = \frac{Tse}{Tsh} \times 100\%$$

Note: Vah = Expert validation

Tse = Total score obtained

Tsh = Total maximum expected score

The results obtained from the formula were then interpreted and categorised according to the product validity criteria presented in the table below.

Table 1. Product Validity Criteria

Score Achievement (%)	Validity Category	Description
85,01 - 100,00	Very valid	Can be used without revision
70,01 - 85,00	Fairly valid	Can be used but requires minor revision
50,01 - 70,00	Less valid	May be used with major revision
01,00 - 50,00	Invalid	Cannot be used

Sources: (Akbar, 2015).

Results and Discussion

The analysis used in this study included needs analysis, curriculum analysis, and student characteristic analysis. This research aimed to develop an interactive learning

media product based on QR codes, suitable for both teachers and students, that would be both valid and practical. Each stage is explained as follows.

Need Analysis

The needs analysis phase was conducted to collect data through interviews with fourth-grade educators at SDN 1 Kedungrejo and SDN 2 Kedungrejo, as well as observations of the school settings. The interviews and observations took place at SDN 1 Kedungrejo on March 5, 2024, and at SDN 2 Kedungrejo on March 6, 2024. The interview with Mr Sholeh, a fourth-grade teacher at SDN 1 Kedungrejo, revealed that the learning process at the institution is functioning effectively under the Merdeka Curriculum, and that the facilities are sufficient, encompassing a library, laptops, LCD projectors, and internet connectivity. He also indicated that the requisite learning resources for the Pancasila Education subject, including teaching materials, worksheets, and poster-based media, were already accessible. Nonetheless, despite the adequacy of facilities and educational resources, media-based learning—specifically regarding the application of Pancasila values in everyday life—has not been employed, and engaging learning media, particularly audio-visual tools, have not been utilised, despite the supportive infrastructure. The instructor emphasised the significant role of media in the educational process, as it facilitates students' comprehension of the learning material, particularly in applying Pancasila values in daily life.

Curriculum Analysis

A curriculum analysis was conducted to review the curriculum implemented in SDN 1 Kedungrejo and SDN 2 Kedungrejo, specifically the Merdeka Curriculum for Pancasila Education. Pancasila Education aims to educate Indonesian citizens to become responsible individuals who understand their rights and obligations, and who cultivate a sense of nationalism and love for their homeland. The analysis of the Pancasila Education subject in relation to the learning outcomes and objectives indicated that this subject can be taught to students beginning from the elementary school level.

Table 2. Learning Outcomes and Learning Objectives

Learning Outcomes	Learning Objectives
Students can define and explain Pancasila principles and give examples of applying them in daily life based on their development and context. Students can apply Pancasila values in family, school, and community settings.	Through discussion activities, students can explain the values of Pancasila (C2).
	Through video presentations, students can analyse real-life cases that correspond to the principles of Pancasila (C4).
	Through pictures, students can analyze examples that correspond to the fourth principle of Pancasila in everyday life (C4).

Student Characteristics Analysis

The student characteristics analysis was conducted through interviews with the fourth-grade teacher. The results showed that there were 33 students in fourth grade at SDN 1 Kedungrejo and 32 students in fourth grade at SDN 2 Kedungrejo. Based on the analysis, it was found that the students tended to enjoy technology and preferred the Interactive Ludo Media, which utilised QR Codes.

Evaluation of the Analysis Results

The evaluation of the analysis results, which included the needs analysis, curriculum analysis, and student characteristics analysis, confirmed that all aspects fulfilled the research requirements. The data obtained through interviews, observations, and questionnaire responses were sufficient to provide the necessary information for the study. Based on these analyses, it can be concluded that both teachers and students require learning media that are valid, practical, and engaging to help students overcome challenges in learning Pancasila Education, particularly in understanding the application of Pancasila values in daily life.

Design

Based on the results of the needs analysis conducted through teacher and student interviews, it was found that fourth-grade students rarely play traditional games and require learning media that can help them understand the material on applying Pancasila values in daily life. Therefore, the researcher designed a product in the form of a traditional game that has been modernised using QR Codes and modified with content related to the application of Pancasila principles in daily life. The first step in developing the Interactive Ludo Media Based on QR Codes was to select materials aligned with the learning outcomes of Pancasila Education for fourth-grade elementary students.

Developing the design of a guidebook

The guidebook developed contained definitions of the Interactive Ludo Media Based on QR Codes, the game's objectives, developer profiles, usage instructions for teachers and students, the game route, and directions for playing. The section on definitions explained what the Interactive Ludo Media Based on QR Codes is, while the objectives section described the intended learning goals. The developer profile included the developer's identity, and the usage instructions provided general guidelines for teachers and students. The game route section contained illustrations of the board layout, and the instructions section provided step-by-step directions for playing, along with QR Codes to facilitate the use of the Interactive Ludo game in the classroom (Figure 1, in the Appendix).

Developing an Interactive Ludo Banner Based on QR Codes

The game board for the Interactive Ludo Media Based on QR Codes included four start boxes representing different groups: the chain group, the rice and cotton group, the bull group, and the banyan tree group (Figure 2). The game could be played by two to four groups, with each group having four tokens that one to eight students could play. The route contained a finish line and various zones marked with symbols. A box with a book symbol represented the material zone, a question mark indicated the question zone, a star symbol represented the bonus zone, and a cross symbol represented the challenge zone (Figure 2, in the Appendix).

The game also used a QR Code scanning application installed on a laptop connected to an LCD projector (Figure 3, in the Appendix). When the QR Code on a material or question card was scanned, it displayed related pictures, videos, or audio content. Each Ludo card contained learning materials about the application of Pancasila values in daily life (Figures 4 and 5, in the Appendix). The cards presented explanations of the meaning of each Pancasila principle along with examples of how these principles are practised in everyday situations. This feature helped students better understand the material and answer the questions provided during the game (Figures 6, 7, 8, in the Appendix).

The question cards contain items derived from the material cards to assess students' understanding of Pancasila values in daily life. Meanwhile, the bonus cards (Figure 8) provide rewards that allow players to advance more quickly than others. These rewards include actions such as moving forward one to two steps, making three opponent pawns move back one step, or moving one pawn directly to the finish line.

The challenge cards (Figure 9 in the Appendix) contain tasks or obstacles that influence the players' movement, such as requiring them to move back one to two steps. The pawns in the Interactive Ludo Game based on QR Code consist of a total of 32 pieces, representing the students themselves. Each group has eight pawns, and each set of pawns corresponds to the colour assigned to that group. The Interactive Ludo Game based on QR Code utilises a single die, which is used to move the pawns along the game path. The die measures 30 cm in size (Figure 10, in the Appendix).

Development

The development of interactive Ludo learning media based on QR codes was carried out through several stages, namely: (1) designing the interactive Ludo based on QR codes using Adobe Photoshop and Adobe Illustrator applications, (2) printing the game design on a 3m x 3m banner, (3) printing the guidebook using art paper, (4) printing the material cards, soul cards, bonus cards, answer keys, and scoring sheets using cardboard coated with laminated stickers, (5) creating the dice using cardboard shaped into a cube and coated with stickers, and (6) using the students themselves as the game pawns. Based on the completed design, an interactive Ludo game featuring QR codes was developed. After the product development process was completed, material and media expert validators conducted the validation process using validation sheets to assess the product's validity. The collected data consisted of quantitative data obtained from the validation instrument assessments and qualitative data from the recommendations of validators and classroom teachers.

Implementation

After revising the interactive multimedia-based learning media in response to the given feedback and suggestions, the next stage involved implementation through small-scale and large-scale trials. The small-scale trial was conducted with 9 fifth-grade students of SDN 2 Kedungrejo, while the large-scale trial involved 32 fourth-grade students of SDN 1 Kedungrejo to test the practicality of the product. The small-scale trial obtained a practicality score of 100%, categorised as very practical and usable without revision, and was subsequently used for the large-scale trial. The large-scale trial achieved a practicality score of 96.65%, indicating that the interactive Ludo learning media based on QR codes is highly practical and can be used without revision.

Evaluation

The next stage was the evaluation, in which the developed product was reviewed to identify and eliminate any errors that might have occurred during the previous stages. It was necessary to provide guidance and supervision for students when using the interactive Ludo learning media, which utilises QR codes. The guidance was intended to help students better understand and stay focused while using the interactive Ludo learning media based on QR codes, both in comprehending the material and in operating the media. Overall, students participated enthusiastically and actively throughout the learning activities using the interactive Ludo learning media based on QR codes. From all the stages that had been carried out, the evaluation was expected to produce a learning media product in the form of an interactive Ludo game based on QR codes, which is valid and practical for use in the Pancasila Education learning process. The evaluation results are presented in Table 3.

Table 3. Before and After Media Revision

No.	Before Revision	After Revision
1.	The spelling of several words was not in accordance with the Indonesian Dictionary (KBBI).	The spelling of several words was not in accordance with the Indonesian Dictionary (KBBI).
2.	Several levels of material difficulty were not yet aligned with the cognitive levels of Bloom's taxonomy.	Several levels of material difficulty were not yet aligned with the cognitive levels of Bloom's taxonomy.
3.	The learning objectives were still at the LOTS (Lower Order Thinking Skills) level.	The learning objectives were still at the LOTS (Lower Order Thinking Skills) level.
4.	The map image on the banner was not removed.	The map image on the banner was not removed.
5.	Optimization of the graphic aspect (composition) was still needed.	Optimization of the graphic aspect (composition) was still needed.

Validity of the Interactive Ludo Learning Media Based on QR Codes

The learning media product resulting from this research and development, in the form of QR-code-based interactive media, has been proven to be highly valid and beneficial for use during the learning process. To analyse the interval data obtained from the product trials, an analytical technique was applied following the method described by Sahara and Rapita Silalahi (2022), which involved calculating the average score from the validators' responses and then converting the data into a percentage using a specific formula to determine the level of validity. The validity test of the learning media, specifically the interactive Ludo media based on QR codes, was conducted by involving media experts, material experts, and teachers. The recapitulation of the validity test results obtained from the experts is presented in Table 4.

Table 4. Recapitulation of Validity Test Results

No	Assessment Aspect	Validator Scores (%)			Ave.	Cate.	Test Decision
		Material Expert	Media Expert	Teachers			
1.	Linguistic	92,2	-	-	92,2	Very valid	Can be implemented without revision
2.	Accuracy	91,2	91,6	-	91,4		
3.	Presentation	92,6	100	-	96,3		
4.	Display	-	91,6	-	91,6		
5.	Practicality	-	-	100	100		
	Total	276	283,2	100	471,5		
	Average	92	94,4	100	94,3		
	Category	Very valid					

Based on Table 4, the linguistic aspect obtained a score of 92.2%. This aspect concerns how language is used in the interactive Ludo learning media based on QR Code, specifically whether it follows the Indonesian Dictionary (KBBI) and whether students can clearly understand the language used. Some words or sentences were noted by the validator as possibly difficult for fourth-grade students to understand. This finding is consistent with Putri (2020), who stated that learning media should use language that follows the Indonesian Spelling System (EYD) and the vocabulary of the KBBI, appropriate to the child's developmental stage, to facilitate students' understanding of the material being taught.

The content accuracy aspect obtained a score of 91.2%. This aspect evaluates the accuracy and appropriateness of the material presented. According to Poerwadarminta (1976), the concept of suitability involves compatibility, alignment, and coherence. Therefore, the analysis of suitability can be interpreted as an examination of whether a research subject, or in this case, a learning material, aligns with the intended objectives. This indicates that the interactive Ludo learning media based on QR Code presents material accurately in accordance with the curriculum. This finding aligns with Abdurrahman et al. (2020), who stated that effective learning media should include content consistent with the curriculum and support students in achieving learning objectives optimally.

The presentation aspect received a score of 92.6%. This aspect assesses how the material is delivered through the interactive Ludo learning media, utilising QR codes. The results show that the material presentation in the media was excellent; however, the validators provided suggestions for improvement. The revision focused on removing the image of the map of Indonesia from the banner, as it would be stepped on by students during the activity.

The display aspect obtained a score of 91.6%. This aspect evaluates the completeness and clarity of the interface and visual layout presented at the beginning of the learning media. According to Robert Gagne (1977), learning activities, also referred to as teaching activities, include the following steps: (1) developing interest and focusing students' attention to prepare them for learning, (2) communicating learning objectives so that students understand expectations, (3) delivering learning content, (4) providing

guidance or learning instructions, and (5) assisting students in learning. These elements are reflected in the media's video and audio components, which are presented accurately, completely, and in detail.

The practicality aspect obtained a score of 100%. The practicality of the interactive Ludo learning media based on QR Code was derived from teacher needs analysis questionnaires conducted during the trial and testing stages. The practicality assessment reached 100%, indicating excellent usability. Referring to Pratama Murtikusuma (2015), a practicality score ranging from 90% to 100% falls into the very practical category, meaning that the product can be implemented without revision.

As a result, the material expert validation achieved an average score of 92%, the media expert validation achieved 94%, and the teacher's practicality assessment reached 100%. Therefore, the combined results from the three evaluations yielded an overall score of 94.12%, indicating that the interactive Ludo learning media based on QR Codes is highly valid and practical, and can be used without modification.

Practicality of the Interactive Ludo Learning Media Based on QR Code

The practicality of the learning media product, in the form of an interactive Ludo game based on QR Codes, was also assessed based on questionnaire results completed by students and teachers during the trial activities. The interactive Ludo learning media, utilising QR codes and the material '*Application of Pancasila Values in Daily Life*,' obtained a score of 100% in the small-scale trial and 96.65% in the large-scale trial, with an average practicality score of 98%. This score indicates that, in the practicality test, the media falls into the *very practical* category.

Conclusion

The material expert and two media experts have verified the interactive Ludo learning media based on QR codes for the Pancasila Education subject in fourth-grade elementary school. To determine the level of attractiveness, the media underwent a practicality test involving users, specifically fourth-grade teachers from SDN 1 Kedungrejo and SDN 2 Kedungrejo, as well as a small group trial with nine fourth-grade students from SDN 1 Kedungrejo and a field trial with 32 fourth-grade students from SDN Kedungrejo. The validation results from the material expert reached 92%, categorised as *very valid*, while the validation from the media experts reached 94%, also categorised as *very valid*. Therefore, it can be concluded that the interactive Ludo based on QR codes is appropriate and can be used without revision. In the small group trial, the practicality score from the users (teachers) reached 90%, and in the field trial, the obtained score was 96.7%, indicating that the Ludo media is *very practical* according to the users (teachers) without requiring revision. The field trial achieved an attractiveness score of 99%, while the small group trial achieved 98%, showing that the product is *highly engaging* and can be used without modification.

Although the overall results indicate that the media falls into the *very valid*, *practical*, and *attractive* categories, several recommendations and inputs were provided as references for product improvement. These include: (a) the steps in the user manual could be presented in illustrated text form; (b) numbers should be added to the pawns as markers; and (c) the instructions in the user manual should be made clearer to facilitate easier use.

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Appendix

Figure 1. Guidebook

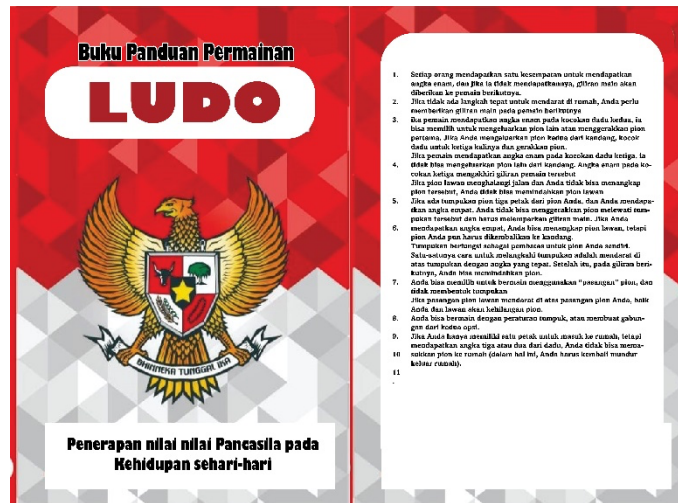


Figure 2. Interactive Ludo Banner Based on QR Codes



Figure 3. QR Code Scanning Application

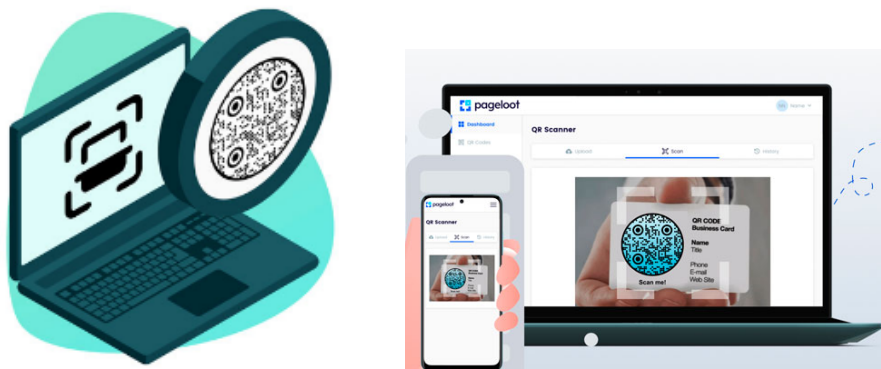


Figure 4. QR Code Scanning Application



Figure 5. Display of Results When Scanning a Barcode



Figure 6. Question Cards



Figure 7. Display of Results When Scanning the Barcode



Figure 8. Bonus Card Illustration



Figure 9. Challenge Card Illustration



Figure 10. Dice Illustration

