



Development and Effectiveness of QR Code-Assisted Pop-Up Books to Improve Elementary School Students' Conceptual Understanding

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Abstract

This study aims to explain the development procedure and analyze the improvement of understanding of second-grade students of MI Ar Ridlo Malang using Pop-Up Book media assisted by QR Code. This research adopted the ADDIE model, involving 13 second-grade students of MI Ar Ridlo Malang. Data collection was carried out by observation, interviews, questionnaires, and tests. Qualitative data were analyzed using thematic analysis techniques, while quantitative data were analyzed using descriptive statistics techniques. The findings show that the Pop-Up Book product assisted by QR Code obtained a validation score of 99% for the material and 85% for the media, so it can be categorized as "very valid" and worthy of trial. The increase in student understanding was also significant, seen from the average pre-test score of 66.1 which increased to 90 in the post-test. Thus, this media is very valid and effective in improving students' understanding of Pancasila.

Keywords:

learning Media; Conceptual Understanding; Pop-Up Books; Elementary School

A. INTRODUCTION

Understanding is the ability of students to explain the material they have learned in more detail. In Pancasila learning, understanding not only includes knowledge but also the instilling of values. According to Khaidaroh in Febiana Wahyuni Warsono Fauziyah, understanding is one level above memorization because it involves the ability to explain the material that has been learned in more depth (Fauziyah & Warsono, 2022).

The level of student understanding is influenced by internal factors, such as interest and motivation to learn, health conditions, and attention during learning, as well as external factors such as teaching methods, parental support, economic conditions, and family harmony. Low student comprehension indicates the need to renew learning strategies and methods (Husain, 2019). Improving student comprehension is part of improving the quality of education. Students will find it easier to follow the learning process and apply the material in their daily lives if they have a good understanding. This is in line with Bloom's opinion in Rusdi (2018), which states that "here we are, using the term 'comprehension' to include those objectives, behaviors, or responses

which represent an understanding of the literal message contained in a communication." Therefore, students are not only required to know the content of the material, but also to understand and use it appropriately (Rusydi et al., 2018). Based on the above definition, it can be concluded that comprehension is a deep understanding of material taught by the teacher, enabling students to apply what they have understood. By understanding the material, students can easily solve problems, which highlights the importance of student comprehension of the material.

Based on the results of observations and pre-field interviews conducted by the researcher, several problems were found in learning in Grade 2 at MI Ar Ridlo Malang, particularly in the material "the importance of understanding rules" in the Pancasila subject. Students did not yet understand the concept of rules correctly because they tended to interpret rules as good behavior that must be done, not as provisions that regulate actions. This was conveyed by the teacher in charge of the Pancasila subject, who explained that students' understanding of the rules was still incorrect. In addition, teachers did not yet utilize learning media, both conventional and digital, in explaining the material, so that students' attention was easily distracted. Some students appear unfocused, and some even play on their own during the learning process. This situation makes it difficult for students to understand the material being taught. From these various obstacles, it can be concluded that interesting learning media are needed to foster students' interest in learning so that they can more easily understand the material being presented.

The importance of using learning media to improve student understanding has been proven by many experts. Research by Septry Rachma Nella & Ike Sylvia shows that comic media is effective in improving student understanding (Nella & Sylvia, 2020). Research by Alfi Nur Jannah also shows an increase in student understanding of animal life cycle material after using pop-up book media (Jannah, 2019). Similar results were shown by Elva Zuleni et al., who found that pop-up books are effective in improving understanding of science concepts (Zuleni & Marfilinda, 2022). These three studies emphasize the importance of conventional media in supporting student understanding. Meanwhile, research by Alvi Rohmawati Fadilla shows that interactive video media is effective in improving student understanding (Fadilla, 2020). Zainal's research also found that electronic media and the use of Edmodo can improve students' understanding of economic concepts and their average scores (Zainal, 2019). In addition, research by Dewi Anjani et al., who developed QR Code-based media, showed positive results in increasing student interest and understanding. These three studies emphasize that digital media tends to attract students' attention more and is effective in supporting the comprehension process (Anjani et al., 2021).

Several studies have shown the effectiveness of Pop-Up Books in learning. Research by Rahma Setyaningrum shows that Pop-Up Books are able to attract students' attention and help them understand the material being taught (Setyaningrum, 2020). Research by Lailatus Suroiha et al. states that Pop-Up Books are relevant to use because they can increase students' interest in learning and indirectly encourage critical thinking skills (Suroiha et al., 2022). Research by Wafi Nur Azizah, who developed QR Code-assisted Pop-Up Books, also shows that students are more interested in new, attractive, and technology-based learning media (Azizah, 2022). All three studies focused on developing Pop-Up Books to attract students' interest in the subject matter. Therefore, the researchers were interested in developing conventional media combined with digital media in the form of QR codes and puzzle games, which aim to improve students' understanding of the subject matter, "the importance of understanding rules." The focus of this study is on developing QR code-assisted Pop-Up Books as an effort to improve the understanding of second-grade students in Pancasila lessons. Understanding important rules is taught so that students have clear behavioral boundaries. By understanding the rules both in and outside of school, students will grow into disciplined individuals who obey the rules and are able to control themselves (Annisa, 2019). For this reason, the development of QR Code-assisted Pop-Up Book media is expected to not only facilitate students' understanding but also increase their interest in learning

B. METHODS

This study used a research and development (R&D) approach, which is a research method that aims to create a specific product and test how effective it is (Sugiyono, 2015). The Pop-Up Book with QR codes for Pancasila material is the product developed in this study. There are five stages included in the ADDIE development model, consisting of analysis, design, development, implementation, and evaluation (Reiser & Molenda in Branch, 2009). This model was chosen because it has systematic and relevant stages for the development of effective learning media and allows for validation at each stage to ensure that the final product is of good quality.

This research was conducted at MI Ar-Ridlo in Malang City and involved 13 students and Pancasila teachers in grade II. To identify needs and problems in the learning process, this analysis conducted observations and interviews with classroom teachers and subject teachers. Next was the design stage, which included planning the content and appearance of the Pop-Up Book and creating a storyboard using the Canva application together with the Pop-Up Book designer. The development stage consisted of creating the initial product and validation by subject matter experts, media experts, and learning practitioners. Once the media was deemed feasible, the implementation stage began with a direct trial in the classroom. The effectiveness of the product was assessed through observation, expert assessment, and student tests.

In this study, the data collection methods consisted of tests and non-tests. Tests were conducted through pre-tests and post-tests to determine whether students had gained a better understanding of the material needed to understand the rules. Non-test techniques included interviews, observations, and validation questionnaires. Interviews were conducted to find out the tools used by teachers and the problems in their teaching. During learning, participatory observation was used to monitor student participation and media effectiveness. Experts verified the material and media with questionnaires. The suitability of the material content, media display, technical specifications, and learning aspects were some of the standard indicators used to create the instruments used.

Data analysis is conducted quantitatively and qualitatively. Qualitative data in the form of observation and interview results are analyzed descriptively to support product development. Quantitative data is obtained from expert validation results and student comprehension test results. Validation results were analyzed using a Likert scale to determine the level of media suitability, while improvements in student understanding were analyzed using the normalized gain (N-Gain) formula to see the difference between pre-test and post-test scores. The interpretation of gain values was classified into three categories: high ($g > 0.7$), moderate ($0.3 \leq g \leq 0.7$), and low ($g < 0.3$) as indicators of the effectiveness of the developed learning media.

C. RESULT & DISCUSSION

This research and development aims to produce teaching materials in the form of a *QR Code-assisted Pop-Up Book* on the importance of understanding the rules of the Pancasila subject for second-grade students, which is valid based on the scores from expert validators and the results of trials with second-grade students at MI Ar-Ridlo Malang. The results of the development are explained as follows:

Analysis

The analysis stage involved collecting information by conducting observations and pre-research interviews with class teachers and Pancasila subject teachers in grade II at MI Ar-Ridlo Malang. The results of interviews with Pancasila subject teachers stated that Pancasila learning on the importance of understanding rules in Grade II faced obstacles, namely a lack of understanding among students in comprehending the rules (). The cause of this obstacle was the lack of variety in the learning media used; Pancasila subject learning used the ESPS Pancasila

Education book. After identifying the problems and needs of students, the researchers then designed product development as a solution to the problems.

As a solution to this problem, the researcher developed a *QR Code*-assisted *Pop-Up Book* learning medium as a learning medium for the important material of understanding rules for grade II at MI Ar-Ridlo, tailored to the needs of students.

Design

The design stage began with determining the material to be developed according to the students' needs. In this development, the material used was the importance of understanding rules. The next step was to create a *storyboard* using the Canva application. The Canva application is a tool that can be used to create designs online. The researcher prepared videos related to the material, then converted them into *QR codes* and prepared learning reflections in the form of *puzzle games*. The following is the *storyboard* designed by the researcher. *The Pop-Up Book storyboard* above was then submitted to the *Pop-Up Book* designer to be redesigned. The following is the result of the *Pop-Up Book* design for the material on the importance of understanding rules in Pancasila lessons.

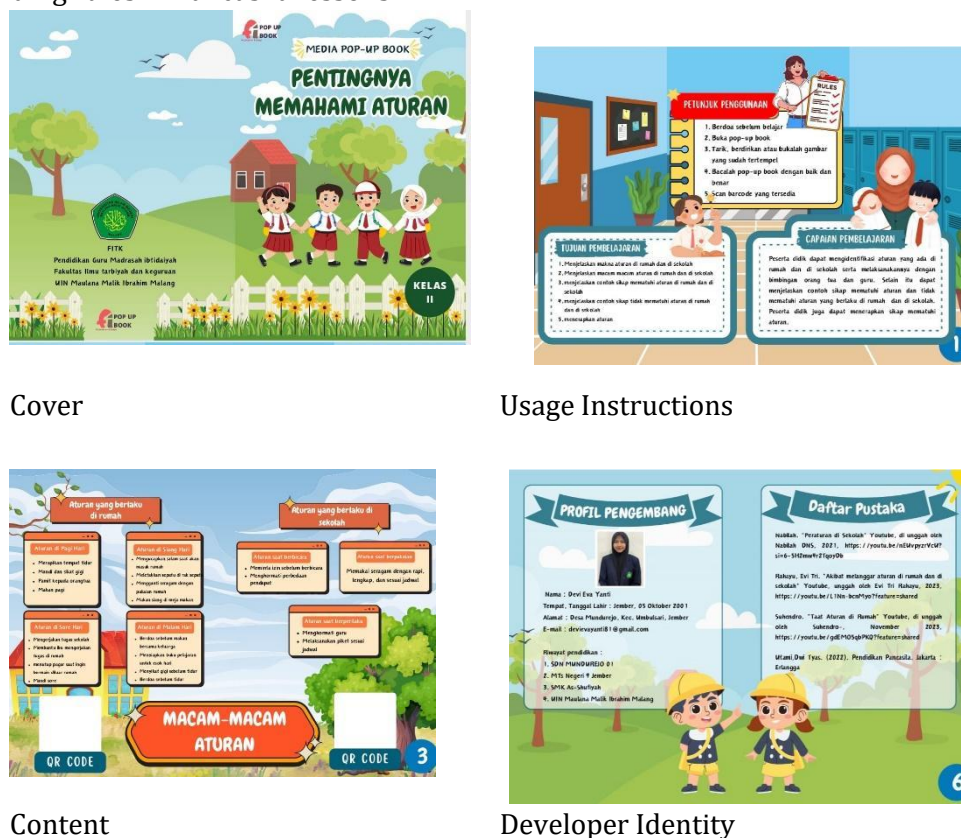


Figure 1. Pop-Up Book Design

Development

The development stage of the *Pop-Up Book* was carried out by media experts due to the researchers' limitations in creating Pop-Up Books. At this stage, the researchers prepared materials on the importance of understanding the Pancasila subject rules for second grade and *QR codes* containing videos on the importance of understanding the rules to be included in the *Pop-Up Book*. The materials and *QR codes* are listed in the following table.

Next, validation is carried out. Validation is carried out by two validators, namely subject matter experts and media experts. Validation is carried out to assess the suitability of the media that has been developed. After validating the media, the researchers analyze the data based on the questionnaire that has been shown to the experts in order to determine the suitability of the media that has been developed. In addition, the researchers also make revisions in accordance with the suggestions of the validators before the media is implemented.

Table 1 of Subject Matter Expert Validation Results

No	Dimension	Score	P (%)	Criteria
1	Completeness of Material	99	100	Highly Valid
2	Material Suitability for Learning Objectives	100	100	Highly Valid
3	Breadth and Depth of Material	100	100	Very Valid
4	Presentation of Material	100	100	Very Valid
5	Reference Suitability	100	100	Highly Valid
Total	Average	99.8	100	Highly Valid

The validation results from the experts show that the developed Pop-Up Book media has a very high validity level, with a validity score of 99% from subject matter experts and 85% from media experts. This validation indicates that the media meets quality standards and is suitable for use in the learning process. In addition, a trial involving 13 second-grade students at MI Ar Ridlo Malang showed a significant increase in understanding.

Table 2 of Media Expert Validation Results

No	Dimension	Score	P (%)	Criteria
1	Product Identity	19	95	Highly Valid
2	Product Display	47	94	Very Valid
3	Product Specifications	19	85	Very Valid
Total	Average	85	90	Highly Valid

Implementasi

The Pop-Up Book that has been developed and validated and declared feasible can be tested on 13 second-grade students at MI Ar-Ridlo Malang. During implementation, the researcher first gave a pre-test to determine the extent of the students' knowledge of the material. During implementation, the students were enthusiastic when using the media. Many students enjoyed learning using the Pop-Up Book because it contained many pictures and videos during the learning process.

There was an obstacle during the learning process using *the QR Code-assisted Pop-Up Book*, namely, the students did not bring their cell phones so they could not scan the QR code in the book. However, this obstacle was overcome by displaying the video in the QR code on a projector screen so that the learning process could continue smoothly. After the learning process using the *Pop-Up Book* media, students were asked to complete a *post-test* consisting of 10 questions. This was done to assess students' understanding after using the media.

The average pre-test score was 66.1, indicating the students' initial level of understanding of the material before the learning process began. The average post-test score increased significantly to 90, indicating that, overall, students successfully improved their understanding of the tested material after participating in the learning process. The SD pre-test of 14.8 shows a relatively large variation in students' pre-test scores, with some students obtaining fairly low scores, while others obtained scores close to the highest score. This shows that there were significant differences in the initial understanding among students. The post-test SD of 9.6 shows that after learning, students' scores were more concentrated at higher values (with less variation between students). Although there were slight differences between students, the increase in post-test scores indicates that the majority of students gained a better understanding after learning.

Table 3. Student Comprehension Test Results

Pre-test					Posttest				
N	Min	Max	Mean	SD	N	Min	Max	Mean	SD
13	50	90	66.1	14.8	13	70	100	90	9.6

The results of the descriptive analysis were used for the prerequisite test. Because the sample size was less than 30 (n=13), the prerequisite test in this study used the Shapiro-Wilk method.

Table 4. Shapiro-Wilk Test

Variable	N	Statistic	df	Sig.
Pre-Test	13	0.947	13	0.525
Post-Test	13	0.973	13	0.933

The results of the normality test show that the statistical value is close to 1, which means that the data is close to a normal distribution. The Sig. (p-value) value is greater than 0.05, so it can be concluded that the data is normally distributed. Thus, the statistical test can proceed to the next stage, namely *the paired-sample t test*.

Table 5. t Test Results

N	t	df	Sig	Conclusion
13	15.68	12	0.000	Ho rejected

The table above shows that the p-value of 0.000 is less than 0.05. Thus, the null hypothesis is rejected. Therefore, it can be concluded that there is a significant difference () between the pre-

test and post-test scores. This indicates that the learning process has successfully improved students' scores significantly.

Evaluation

The results of this study explicitly answer the research question regarding the effectiveness of QR Code-assisted Pop-Up Books in improving student understanding. The increase in scores from the pre-test to the post-test shows that this media is able to significantly improve student understanding. This finding is in line with constructivist theory, which emphasizes the importance of interactive and engaging media in the learning process. In addition, the validation results from experts show that revisions made based on validators' suggestions, such as adding stories, adjusting the position of the QR Code, and numbering the pages, were able to improve the overall quality of the media.

There are seven indicators of comprehension achievement according to Ander in his research (Rohmawati, 2020), including interpretation, giving examples, classifying, summarizing, guessing, comparing, and explaining. Based on the results of the study, the researcher found that students had achieved the indicators of comprehension after learning the importance of understanding the rules of Pancasila in grade II using *Pop-Up Book with QR Code*, among which are that students can give examples related to obeying and disobeying rules, students can classify obeying and disobeying rules, students can summarize and explain the important points of understanding the rules well, and students can also explain the benefits of obeying rules and the consequences of breaking rules

This research is a type of research and development (R&D) that uses the ADDIE model (Analyze, Design, Development, Implementation, and Evaluate). The main objective is to create a Pop-Up Book with a QR code for Pancasila lessons, especially on the important material of understanding rules in class II at MI Ar Ridlo Malang. In addition, it also aims to assess how students understand the material. The Pop-Up Book is the final product, equipped with a QR code containing video links to examples of rules and puzzle games for reflection. As a result of product validation testing conducted by experts, this media is considered highly credible and worth trying.

The product validation test results showed that the validators accepted the product very well. With a validation score of 99% from subject matter experts and 85% from media experts, the media was also considered highly valid. However, the validators provided qualitative recommendations for improvement. The addition of stimuli (stories or questions), the removal of time classifications from the rules at home, changes to the layout of the QR code, and the addition of instructions to the puzzle were suggestions made by subject matter experts. Meanwhile, media experts suggested that the page guidelines be included on both sides of the book (odd and even) and that the logo of institutions other than UIN Maulana Malik Ibrahim Malang be removed.

The Pop-Up Book media with QR assistance was implemented for 13 second-grade students at MI Ar Ridlo Malang. Its effectiveness was measured by comparing pre-test and post-test scores. Before using the media, the average pre-test score of students was 66.1, and after using the media, the average post-test score increased to 90. The Normalized Gain (N-Gain) analysis produced a value of 0.7, which is in the high category, indicating a significant increase in student understanding. Therefore, it can be concluded that Pop-Up books equipped with QR codes are excellent learning tools for Pancasila lessons and can improve students' understanding of the

material. This study found that, although the method was successful, there were limitations in that students had difficulty scanning the QR codes.

Previous studies have shown that Pop-Up Books with QR Codes have been used in various elementary school learning contexts with good results. Research conducted by (Widarini et al., 2022) shows the development of Pop-Up Books with QR Codes on theme 8, sub-theme 1 for second grade elementary school students. The results of the study show that subject matter experts and media experts scored 94% and 95%, respectively, while the practicality of the media scored between 90% and 94%. This media is considered valid and practical because it can increase student motivation and understanding of thematic learning.

Another study by (Prashanti & Margunayasa, 2022) produced similar media for second-grade elementary school students with theme 8 and sub-theme 4. Pop-Up Books with QR codes are feasible and practical during the learning process, as evidenced by the media validity score of 4.99 and practicality score of 4.73. This media has been proven to make learning more interesting and help students understand the material more easily. Meanwhile, Ardika et al., 2022) (created the same media for theme 8, sub-theme 2, with a validity score of 4.85 and a practicality score of 4.86, both of which are in the excellent category.

Further research (Yanuardianto et al., 2023) developed Pop-Up Book media with QR Codes to increase student motivation in learning science material at MI Malik Ibrahim Jember. The validation test results conducted by subject matter experts, media experts, and practitioners showed that QR-based Pop-Up Book products are very useful and interesting to use, and received positive responses from students in small and large-scale trials and can improve student understanding in learning. Furthermore, research conducted by (Agus Loreti et al., n.d.) who created a Pop-Up Book about PJOK subjects with a media expert validation score of 88% and a subject matter expert validation score of 89% and a practicality test score of 91%, showed that this media is very feasible to use and can broaden students' understanding of learning materials. Additionally, research conducted by (Hafidah et al., 2024) shows that Pop-Up Books equipped with QR codes received the categories "highly valid" and "highly practical" for use.

D. CONCLUSION

Based on the results of the study, it can be concluded that the creation of QR Code-assisted Pop-Up Book media helps students in second-grade improve their conceptual understanding of the importance of following rules in both school and home environments. The media successfully increased students' motivation and learning interest through engaging visual and interactive elements. The high validation scores from both material and media experts, along with the significant improvement in students' post-test results, indicate that the product is both valid and effective. This success supports the theory that innovative, technology-based learning media can enrich the learning process and enhance students' learning outcomes. Therefore, QR Code-assisted Pop-Up Books can serve as an effective alternative learning tool in elementary education, especially for Pancasila learning materials emphasizing discipline and rule awareness.

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