



Development of QR Code-Based Flash Card Media to Improve Learning Outcomes of Grade IV Students

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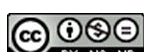
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ABSTRACT

The lack of learning media creates a less effective learning atmosphere, resulting in low student learning outcomes. The purpose of this study was to develop and test the feasibility of QR code-based flash card media on cultural diversity material to improve learning outcomes for fourth grade students. Research and development of the ADDIE model were used as research methods using qualitative and quantitative data analysis techniques. The results of the product feasibility test from the material expert validator and media expert showed a score of 89.4% and 97.3% with a very feasible category. The results of the study showed that the development of QR code-based flash card media on cultural diversity material was quite feasible to use during learning activities and could improve student learning outcomes, according to the results of the t-test showing that the sig. 0.000 means that there is a significant difference in learning outcomes in the pre-test and post-test data. This is also supported by the results of the n-gain test of 0.55 with a moderate category indicating an increase in students' pretest and posttest results when using QR code-based flash card media. The novelty of this research is seen from the development of technology in the form of QR code on card media to overcome students' problems in understanding learning materials with attractive designs and innovations.

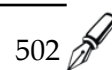


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INTRODUCTION

Learning is the process of changing the behavior of an individual or a person through interaction with their environment. These changes include habits (Habit), attitudes (Affective), and skills (Psychomotor) (Nabillah & Abadi, 2019). WS Winkel emphasized that learning is a mental activity that plays an active role in a person's interaction with their environment. This results in relatively constant and lasting changes in students' knowledge, understanding, skills and attitudes. Developing changes in students is the role of educators in the learning process that refers to learning objectives (Yudiana & Sari, 2022). In order to develop behavioral changes in students, educators should try to create a good learning environment so that students do not get bored easily.

Besides creating a positive learning atmosphere, teachers also need learning aids that can facilitate students' understanding in absorbing lesson materials (Adilah & Minsih, 2022). The media refers to the physical tools used by teachers in conveying messages to students (Maharani & Ramadan, 2023). Students will understand and comprehend better if the teacher in the learning process uses concrete objects that resemble real conditions (Salsabila & Saputra, 2021). Learning media can provide real assistance to students in understanding learning materials (Krisdiana &



Jamaludin, 2023). This is because the media used in education can arouse students' desire to learn, so that learning takes place actively (Alvita & Airlanda, 2021). The statement regarding learning media as described above is justified by (Heryani et al., 2022) stating that by improving learning media, a meaningful learning process can be achieved.

Learning media can help teachers communicate the intent and purpose of the material being taught more easily, so that the learning process can refer to the learning objectives themselves (Utami et al., 2021). The use of media in the learning process can help teachers convey information more easily and improve children's logical thinking (Yuliantoro, 2022; Salsabila & Saputra, 2021). Therefore, to create a positive, creative, effective, and interesting learning atmosphere, teachers need to be more creative and innovative in designing and using learning media (Sulistyorini & Listiadi, 2022; Kesumawati et al., 2022).

With the development of existing technology, flash card learning media has become a more practical, easy and effective learning media (Muhith et al., 2020). The definition of Flash Card is a learning aid in the form of a card containing images and information on one side or both sides at once which can be used in learning activities that arouse students' curiosity. Flash cards are educational aids in the form of cards containing images and words that can be resized according to students' needs (Wahyuni, 2020). The use of flash card learning media is considered very important to clarify and expand students' understanding (Wulandari & Sayekti, 2022). This media can be implemented by learning while playing (Logayah et al., 2023). It is anticipated that the application of learning aids containing images can attract and direct students' attention to focus on the contents of the lesson (Arsyaf et al., 2022; Utami et al., 2024). Therefore, the problems faced by students can be overcome by improving their learning outcomes.

Technology provides new colors in education (Fitriana & Setyasto, 2023). The use of technology in education has been regulated in the Regulation of the Minister of National Education 2 Number 78 of 2009 concerning the Implementation of International Standard Schools at the Elementary and Secondary Education Levels in Chapter II. Part Three concerning Implementation Standards, in Article 5 Paragraph (2) states that "The learning process as referred to in paragraph (1) applies an information and communication technology-based learning approach, active, creative, fun, and contextual". Therefore, a teacher must be able to utilize technology as a media or teaching aid (Rahmayani et al., 2022; Siregar & Ananda, 2023). The existence of media is one alternative for teachers to encourage students to learn (Mulyanto & Mustadi, 2023). Therefore, it is better to use learning media that is full of technology and as much as possible in accordance with learning objectives (Sulistyo & Kurniawan, 2020).

In the problems found today, there are still many teachers who teach using the lecture method (Puspitasari et al., 2022b). Based on the results of interviews, observations, and document recording conducted on Tuesday, November 28, 2023 at SDN Tambakaji 01, there are several learning problems, one of which is that the quality of social science learning still needs to be improved. Learning Natural and Social Sciences (IPAS) in class IV A still applies conventional learning methods where students listen more to the teacher's explanation or (teacher center) so that learning is considered boring. This situation is caused by the lack of learning media which is limited to pictures of heroes, maps, and globes and learning resources that are still limited to YouTube videos, teacher books, and student books. The lack of diverse learning resources makes students less interested in learning and students have difficulty receiving learning materials, so that learning outcomes in the IPAS subject are still low. The use of learning media is considered important in supporting an educator in delivering material easily and also helping students understand and master a learning well and consider it meaningful. Based on observations made, each class already has wifi and LCD, but the learning process has not been carried out optimally. This condition can be overcome by developing existing media, one of which is the development of QR code-based flash card media.

Flash Card based on QR code in the learning process can produce an active learning environment. By combining QR code, the information contained in the Flash Card can be diverse (Sianipar et al., 2023). The display of text, images, videos, evaluation questions and web addresses

is linked to teaching materials (Riandita et al., 2023). QR code (Quick Response code) is a quick scan code which if scanned by the QR Code Scanner application will display the information contained in it (Dellia et al., 2022). So by combining flash card learning media with QR code will be able to create practicality and convenience for students in accessing information about learning (Uyuni & Kuswanti, 2023). Thus, the use of QR code-based flash Cards as learning media is expected to contribute to improving student learning outcomes (Puspitasari et al., 2022a). Problems in education can be done by using various learning resources and the use of learning media to improve student learning outcomes (Puspitarini & Hanif, 2019).

These results are supported by previous research conducted by Hartawan et al. (2024) entitled "Implementation of QR code Technology to Improve Elementary School Students' Literacy Skills". This study aims to instill elementary school students' literacy skills by conducting training. This study shows that students are able to use the QR code board to scan, access websites, and read information, both text, images, and videos. Findings from other researchers state that flash card media is practical and can be used in elementary school grade IV science learning (Shafa et al., 2022). The results of the study state that flash cards are useful as a learning aid. This can be seen from the results of assessments carried out by experts and small group trials as well as large groups that reflect the established criteria. These findings affect the science learning process. To create a positive learning environment, flash cards can be used as an alternative media to help the learning process.

Based on the problems that arise, the researcher wants to study the implementation of science learning. The purpose of this study is to develop and test the feasibility of QR code-based flash card learning media on cultural diversity material to improve the learning outcomes of fourth grade elementary school students.

RESEARCH METHOD

QR code-based flash card media was carried out using the ADDIE development model which consists of 1) Analysis, 2) Planning, 3) Development, 4) Implementation, 5) Evaluation (Sugiyono, 2015; Sudrajat et al., 2023).

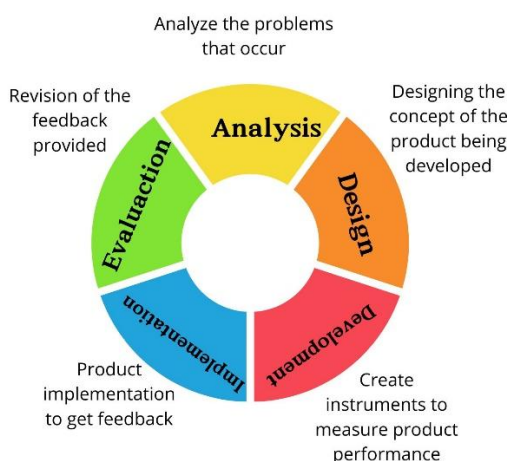


Figure 1. Steps in Developing the ADDIE Model (Sugiyono, 2015)

At the analysis stage, researchers analyze what problems occurred during the study. The planning stage in the ADDIE model begins with designing the concept and content in the product being developed. At the development stage, an instrument is created to measure the performance of a product. QR code-based flash card media is developed according to the plan made, then approved by material experts and learning media experts. The implementation stage is the stage of product application which is intended to obtain feedback on the product that has been created. The implementation was carried out at SDN Tambakaji 01, during the product trial the researcher noted the shortcomings and obstacles in the use of the product, in addition students were given

a questionnaire to assess the QR code-based flash card media that had been developed. At the evaluation stage, the feedback given on the use of the product will be revised and developed based on the product and needs that are not met by the product being developed. This stage aims to determine the success of the product that has been implemented to students .

Data collection used test techniques (pre-test-post-test) and non-test in the form of observation, questionnaires, interview results, and document data. Before the test was given to the sample, the test was first validated theoretically using a grid and consulted with experts, then carried out empirically with a total of 27 students as respondents. From the results of the instrument test which included the Validation Test, Discriminatory Power Test, Difficulty Test, and Reliability Test, 30 test items were obtained which were declared suitable for use in the study from a total of 50 test questions that were tested.

The questionnaire sheet is used to collect data from the review results of material experts and media experts and to test small groups and large groups. Instrument grid presented in **Table 1** , **Table 2**, and **Table 3**.

Table 1. Grid of material expert review instruments

No	Aspect	Indicator
1.	Material Suitability	a. Material according to learning outcomes b. Readings according to the theme and learning materials
2.	Accuracy of Material	a. Supporting student understanding
3.	Benefits of Material	a. Reading in media is useful in improving students' abilities
4.	Linguistics	a. Clear and communicative language

Table 2. Media expert review instrument grid

No	Aspect	Indicator
1.	Material Suitability	a. Material according to learning topic b. Media developed according to learning objectives
2.	Appearance	a. Attractive media display design b. Selection and use of the right font type c. Use of images according to the material
3.	Ease of Use	a. Media is practical b. Media is easy to use for both teachers and students. c. Instructions for use of the media are clear

Table 3. Grid of small group and large group trial instruments

No	Aspect	Indicator
1.	Presentation of Content	a. Presentation of material b. Presentation of practice questions
2.	Technical Quality and Presentation of Material	a. Media view b. Image and color display

Qualitative and quantitative descriptive analysis were used to analyze the data in this study. Qualitative descriptive analysis techniques were used to process data obtained from expert trials and student trials, then grouped into qualitative data in the form of responses, suggestions or criticisms which would later be used to revise the developed product (Yasa et al., 2021). While quantitative descriptive analysis techniques were used to process information obtained from the questionnaire in the form of descriptive percentages. Quantitative descriptive data analysis conducted in this study was by analyzing questionnaire data that had been given to respondents, namely material experts, media experts, small group trial results and large group trial results (Mella et al., 2022). The provisions used to provide meaning and decision-making for the expert questionnaire sheets are presented in **Table 4**.

Table 4. Achievement level convention with 5 scale

Achievement Level	Qualification	Information
0% - 20%	Totally Unworthy	Repeatedly Making Products
21% - 40%	Not feasible	Many things are revised
41% - 60%	Quite Decent	Revised as needed
61% - 80%	Worthy	A Little Revision
81% - 100%	Very Worth It	No Revision Needed

RESULTS AND DISCUSSION

Results

The results of this research product design are in the form of QR code-based flash card media on cultural diversity material containing text, images, videos, and interactive quizzes that can help teachers and students in supporting the learning process. The research subjects were 1 material expert, 1 media expert, 12 small group students, and 27 large group students.

The type of development model used in the study is the ADDIE model which consists of five stages. At the analysis stage, researchers analyze through observation, interviews, and questionnaires. The purpose of this analysis is to determine the needs or problems faced by educators and students when learning. With several problems that arise, one of which is related to the use of learning media that is not yet optimal. So researchers need to conduct an analysis of the development of a new product and analyze the feasibility and requirements for developing a product. At the planning stage, researchers design a QR code-based flash card media product that will be developed by adjusting the learning material that is matched with the needs of students. The design of the QR code-based flash card is also equipped with attractive images, learning videos, instructions for use and quizzes that make it easier for students when learning. At this stage, researchers also prepare complete learning devices and create questionnaires to assess the products being developed. The development stage in the ADDIE model is that researchers develop a previously made design to be made into a complete product. The development stage aims to make text, images, videos, and quiz questions into a product, namely QR code-based flash card media. Flash card media based on QR code was designed with the help of canva, google drive, youtube, wordwall and QR & Barcode Scanner Application. Implementation stage, researchers at this stage applied the revised QR code-based flash card media to grade IV students of SDN Tambakaji 01 to conduct small group and large group trials. At the evaluation stage, the feedback given on the use of the product will be revised and made based on the product and needs that are not met by the product being developed. This stage aims to determine the success of the product that has been implemented to students. A recapitulation of the results of trials by experts and trials by students can be seen in **Table 5**.

Table 5. Recapitulation of QR code-based flash card media trial results

No	Test Subject	Results	Qualification
1	Subject Matter Expert	89.4%	Very Worth It
2	Media Expert	97.3%	Very Worth It
3	Small Group Trial	97.3%	Very Worth It
4	Large Group Trial	93.3%	Very Worth It

Based on the results presented in **Table 5**. The assessment of material experts with very feasible criteria of 89.4% and media experts with very feasible criteria of 97.3%. In addition, the results of small group trials with very feasible criteria of 97.3% and the results of large group trials meet the percentage of 93.3% with very feasible criteria. Based on this assessment, it can be concluded that overall the QR code-based flash card media is feasible to be used in learning activities in grade IV of elementary school. The QR code-based flash card media can be seen in **Figures 2, 3, and 4**.



Figure 2. QR code-based Flash Card display



Figure 3. Front view of QR code-based Flash Card



Figure 4. Rear view of QR code-based Flash Card

This development research uses a normality test to ensure whether the learning outcome data is normally distributed or not, using SPSS **Table 6**.

Table 6. Results of the pretest and posttest data normality test

	Statistics	Shapiro Wilk	
		df	Sig.
Learning Outcome Pretest	.935	27	.091
Posttest Learning Outcomes	.927	27	.059

Based on the results presented, the pre-test and post-test data are normally distributed because Sig is 0.091 and 0.59, which is more than 0.05. Furthermore, the data is tested with paired sample t-test to detect product effectiveness by applying SPSS, which can be seen in **Table 7**.

Table 7. Results of the Difference in Average Pre-test and Post-test (Paired Sample t-Test)

	Paired Differences					Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error	95% Confidence Interval of the Difference		t	df
				Lower	Upper		
Pair 1 Pretest Learning Outcomes -Posttest Learning Outcomes	-29.111	14,415	2,774	-34,813	-23,408	-10,494	26 .000

Based on the findings presented in **Table 7.** shows a significant difference between the pretest and posttest where the value of 0.000 is less than 0.005 (Significance Value). Then the data was analyzed using the n-gain method to identify the average increase between the pre-test and post-test which can be seen in **Table 8.**

Table 8. Mean Increase Results (N-gain)

	N	Minimum	Maximum	Mean	Std. Deviation
Gain	27	.09	1.00	.5546	.22445
Valid N (listwise)	27				

The results of the N-gain test showed a moderate increase, with class IVA students at SDN Tambakaji 01 experiencing an average increase of 0.5546 so that it can be categorized as moderate.

Discussion

The results of this study indicate that QR code-based flash card media is suitable for use in science learning, especially in cultural diversity material in grade IV of elementary school. There are several factors that make this product suitable for use in teaching and learning activities. First, the teaching materials presented in QR code-based flash card media are in accordance with learning achievements and learning objectives. The teaching materials in the developed media have difficulties that are adjusted to the developmental stage of the students, and are also systematically arranged so that students learn more easily (Budi & Miaz, 2023). In developing learning media, the aspect of the suitability of teaching materials with learning achievements and objectives is important (Failasufah & Setyasto, 2023). Second, the use of clear and communicative language and in accordance with the characteristics of the students. The media presents language that is appropriate to the level of thinking of students and is effective and functional. Third, the media is given quiz questions to increase students' understanding, the questions presented are in accordance with the learning achievements developed. This is supported by the statement that students are able to carry out the learning process well with the help of learning aids called learning media (Mulyanto & Mustadi, 2023). Fourth, the appearance of QR code-based flash card media is attractive, equipped with images and colors as well as appropriate learning videos without disturbing the text on the material (Hermansyah et al., 2023; Tama & Oktriani, 2023). The use of digital-based media is more practical and attracts students' interest in learning compared to the use of printed modules (Fidarti & Nurharini, 2023). Interesting learning video media is influenced by the selection of writing colors and text backgrounds in such a way that students can understand the information presented (Dewi et al., 2023; Yusuf & Agung, 2021). Students actively participate in using the technology-assisted card media, because the media display is attractive and easy to use, the text is clearly readable, the selection of composition and color combinations are harmonious, and the media also helps students understand the material and the media can arouse students' learning motivation. In choosing learning aids that can be used,



several factors above must be considered when choosing learning aids based on learning needs and objectives.

These results are supported by previous research conducted by Hartawan et al. (2024) entitled "Implementation of QR code Technology to Improve Elementary School Students' Literacy Skills". This study aims to instill elementary school students' literacy skills by conducting training. This study shows that students are able to use the QR code board to scan, access websites, and read information in the form of text, images, and videos. Findings from other researchers state that media in the form of cards are practical and can be used in elementary school grade IV science learning (Shafa et al., 2022). The results of the study state that card media is suitable as an aid during the learning process. The statement above is supported by assessments carried out by experts and small group trials as well as large groups that show the established criteria. These findings affect the science learning process, to create a positive learning environment, flash card media can be used as an alternative to help the learning process.

CONCLUSION

The results of the study stated that QR code-based flash card media on cultural diversity material for grade IV Elementary Schools is quite feasible to be used in learning and makes students enthusiastic in learning, thus improving student learning outcomes and learning objectives are achieved optimally. QR code-based flash card media has several advantages such as attractive image displays, extensive material content, quality and developmentally appropriate learning videos and interactive quizzes that are in accordance with learning achievements and learning objectives. The author wants to create intelligent 21st century students with literacy skills and the ability to use information technology, by utilizing QR code-based flash card media at the elementary school level first.

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