



The Analysis of QR Code-Based Books to Develop Cognitive Aspects of 5-6 Year Old Children

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Abstract

Appropriate learning media is one of the keys to successful education, especially in early childhood education. This study aims to develop QR code-based books as a means of developing the cognitive abilities of children aged 5-6 years. The research approach uses research and development (R&D) with development models that can be carried out in the classroom, one of which is the ADDIE research model (analysis, design, development, implementation, evaluation). Data collection techniques in this study used observation and questionnaires. The results of the expert's assessment showed that the media got a proportion of 79% in the "Good" category with an interval of 61% -80%. The results of the material expert's assessment got a proportion of 78% in the good category with an interval of 61% -80%. The results of the implementation of QR Code-based books through the results of the assessment that has been carried out by the teacher show that 85% of children get good categories. So it can be concluded that QR Code-based books show proper use in developing children's cognitive development.

Keywords: *qr code-based books; develop cognitive aspects; 5-6 year old children*

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Introduction

Early childhood education is a parenting and coaching effort aimed at children aged from birth to the age of six which is carried out by providing educational stimuli to help stimulate growth and development. Parenting and coaching is not only carried out by parents who act as the child's first school, but teachers also play a role in early childhood education institutions. In PAUD institutions, teachers provide learning through play activities to stimulate aspects of child development. One of the child's development is the aspect of cognitive development. Aspects of cognitive development for early childhood include not only mathematics and science, but also problem solving (Santrock, 2007) and concept mastery (Schunk, 2012).

In early childhood learning requires concrete objects for children to learn. One of them is teaching materials. Teaching materials used by children must be in accordance with the characteristics of the child. One of the forms of teaching materials is children's worksheets/children's books. Student worksheets are sheets that contain assignments that must be completed by children to be assessed by the teacher. Children's worksheets are usually

preceded by instructions and completion steps (Fatimah, 2019). This is also supported by (Purnamasari, 2017) which states that worksheets are an example of print media which are usually used as guidelines for carrying out a learning activity and can also be used as a learning tool.

Children's worksheets or better known as student worksheets are sheets that contain activities that must be done by children to understand a material. As expressed by Prastowo (2015) student worksheets are sheets containing tasks that must be done by students, which include instructions and work steps in completing a task according to the basic competencies to be achieved. Apart from containing assignments that must be done by students, (Mujid, 2014) states that student worksheets also contain instructions for completing a task.

Children worksheets are also one of the tools used to make it easier to understand the material, to increase student activity in improving their learning achievement (Ramadhan, 2014). "Worksheets usually have corrected—and incorrect—answers. They are implicitly closed activities, at which some children will succeed, and some will fail" (Ransom & Manning, 2013), therefore, in designing worksheets, educators should really adjust to the goals to be achieved so that the activities in the worksheets can facilitate understanding a material.

Student worksheets should also use attractive color gradations (Steady et al., 2019) and displays that have images to support the content of the book (Thepsatitporn & Pichitpornchai, 2016) This is done because children are learners of new things and will increasingly want to learn if there is something that makes it interesting. Pictures are also provided in the children's worksheet book because children learn through concrete objects.

Based on the results of observations made by UM Surabaya students who carried out teaching assistance activities, the researchers concluded that one of the early childhood learning materials was a book that was not in accordance with its development. Especially on cognitive development. The books used by teachers in several ABA Surabaya Kindergarten schools use books that directly address counting, writing, and reading. There is no assimilation of old knowledge with new knowledge.

Researchers also conducted interviews with UM Surabaya students who had taught at several ABA Kindergarten schools regarding the use of children's textbooks. In the interview process it was found that the teacher used textbooks without the assimilation process due to the limitations of learning media as supporting materials for the textbooks. So that researchers are interested in developing children's books by utilizing the technology that is currently developing.

The role of technology in learning is to facilitate, optimize and assist children's learning processes (Rahmad Putra, 2020). Technology that is currently widely used in learning, one of which is the QR code. QR Code is a two-dimensional symbol. It was invented in 1994 by Denso, one of the Toyota Main Group Companies, and approved as an ISO international standard (ISO / IEC18004) in June 2000 (Smith, 2016). This two-dimensional symbol was originally intended for use in controlling the production of automotive parts, but has become widespread in other fields, one of which is in the field of education. QR Code is a type of matrix or two-dimensional barcode, the code can store data information and is designed to be read by smartphones (Tiwari, 2016). QR stands for "Quick Response". The QR code is designed to allow its content to be decoded at high speed. The code consists of black modules arranged in a square pattern on a white background. The encoded information may be text, URL, or other data (Shin et al., 2012).

In addition, the children nowadays have interaction more in technology. However, several prior researches do not focus on sophisticated technology. Therefore, current books publish with QR code in order to occupy their interest. Several prior researches also analyze the development of sophisticated technology in textbook, such as the development of the Active Textbook System (A-txt). This research focuses only on the advantage of the system, and are applicable in android but the system needs improvement in iOS. Moreover, the research do not discussed how appropriate the textbook in teaching and learning process

(Suzuki et al., 2019). Another research is the development of text book based on scientific theme. It reveals that based on the validation range, this book is very interesting to applicate in vocational school (Yafi et al., 2022). Therefore, this research provides the novelty in using sophisticated technology which is applicable and also illustrates how applicable the content in teaching and learning process.

The results of research conducted by (Mousa, 2016) show that QR codes are used as an alternative medium for scanning learning resources at the kindergarten level. Furthermore, the results of Bakri's research (Bakri, 2018) concluded that the use of the QR code has great potential to be used to support more effective learning. The QR Code can also be used in the introduction of science concepts in early childhood (Hance, 2014). In this study, a QR code will be added to a children's book which contains a brief explanation of material related to the task to be completed by the child. This is expected to help children in the process of assimilating children's knowledge. This QR Code also contains videos in the real world of children so that it makes it easier for children to acquire knowledge according to the characteristics of the child.

Methodology

Development research or research and development (R&D) is a basic research activity to obtain information on user needs, then continued with development activities to produce products and examine the effectiveness of these products (Sugiyono, 2006). There are many development models that can be carried out in the classroom, one of which is the ADDIE research model (analysis, design, development, implement, evaluate). The ADDIE model is used for the development of teaching materials (Cahyadi, 2019; L. Orland-Barak, 2017). The first stage is Analysis, researchers conduct analyses related to children aged 5-6 years, material and learning objectives through observation; the second is Design, researchers in designing teaching books to be developed, namely based on the results of the analysis; designing indicators that will be used in data collection and validating to research experts and educational evaluation. The third is developing followed by product validation by media experts; the fourth is Implementation, which is piloting validated products and the final step is to evaluate the results of the trial by looking at the results of filling out questionnaires by users. The research instrument for product validation uses a Likert Scale with a scale of 1-4, ranging from agree (1) to strongly agree (4). The validation test data analysis technique uses descriptive percentage and categorical techniques to develop the feasibility of QR Code-based coursebooks to develop cognitive aspects of children aged 5-6 years. At first the score is percentages using the formula:

$$AP = \frac{\text{Actual Score}}{\text{Ideal Score}} \times 100\%$$

Description:

AP: Percentage Score

Actual Score: Score given by expert validator

Ideal Score: The maximum score is the product of the number of items with the maximum score of each item.

The percentage figures are then grouped into five categories as presented in table 1.

Table 1. Validation Test Categories

Interval	Category
81% - 100%	Very good
61% - 80%	Good
41% - 60%	Fair
21% - 40%	Deficient

1% - 20% | Very Poor

Design validation is carried out by experienced experts to assess learning media. The experts who carry out the assessment are media and material experts. Media experts assess the overall design that has been made to find out the weaknesses and strengths of the product through live discussion forums. Material experts assess the overall content of the material that has been made to find out the weaknesses and strengths of the product through a questionnaire.

Results and Discussion

Analysis

Initial information is done by analyzing the need for children's books based on QR Code. This activity was carried out through interviews conducted with teachers at TK ABA 6 Surabaya. This is done to verify the results of initial observations. This analysis activity starts with questions related to the cognitive development of children aged 5-6 years in Kindergarten ABA 6 Surabaya, then the learning resources used in the learning process. From the results of these observations, it can be concluded that in ABA 6 Kindergarten Surabaya using books purchased in a coordinated way and indeed the books used are more for the ability to write, count and read without any introductory material or activities. Then the researcher offers to develop a QR Code-based textbook which later in the book can be scanned by the teacher and can display videos in a real environment.

Design

In this stage, the researcher takes the first step, namely designing the book first. Starting from the cover design and layout. The number of pages of this book is 20 sheets with A4 paper size. The number of pages includes the cover page, preface, table of contents and material. After that the researcher took a video at the zoo which will be used to make the video listed on the QR Code. Then make questions according to the video in the QR Code. The questions in the book include grouping and connecting questions. For an example of the book sheet can be seen in Figure 2 while the video in the QR Code can be seen in Figure 3.



Figure 1 Example of Book Design



Figure 3 Animal introduction video

Developing

Researchers in developing QR Code-based books to develop cognitive development are then validated first. Based on the results of product validation research carried out to produce teaching materials that are feasible and ready to be used by children (Muhammad et

al., 2023; Schiefele & Schaffner, 2016). Media validation was carried out by media experts and material experts. These experts are experienced lecturers in accordance with the media developed. Media validation aims to obtain information, criticism, and suggestions so that the media developed by researchers becomes a quality product in terms of content and objectives. In general, QR Code-based books are considered good to be used as an alternative to develop cognitive development in children aged 5-6 years. The following is the validation result.

Table 2. Media and Material Expert Validation Results

Expert	Assessment Aspect	Number of Assessment	Ideal score	Actual score	Percentage	Description
Media	Image quality	4	16	14	79%	"Good" with an interval of 61% - 80%
	Sound	4	16	12		
	Music	3	12	9		
	Duration	1	4	3		
Material	Correctness of language	3	12	10	78%	"Good" with an interval of 61% - 80%
	Appropriateness of cognitive aspects	2	8	6		
	Conformity with AUD characteristics	3	12	9		

In accordance with table 2, the results of the media expert's assessment got a percentage of 79% in the "Good" category with an interval of 61% -80%. According to media experts, QR Code-based books have the following advantages: 1. When the teacher scans the QR Code to open the material, the material contains not only pictures but also sounds and music. This will give children a sense of joy, because learning uses an interesting method, 2. The material in the book is directly related to the child's closest/real environment for the child. The drawback of this QR Code-based book media is the selection of colors that are too bright so that it makes the eyes tired quickly. The results of the assessment from material experts got a percentage of 78% in the good category with an interval of 61% -80%. QR Code-based books for developing cognitive aspects are in accordance with the stages of development and abilities of children aged 5-6 years, but there are drawbacks, namely the variety of questions is still lacking. Even though there are still things that need to be improved, the QR Code-based book shows that it is feasible to use in developing cognitive development.

Implementasi

The implementation of this QR Code-based book product was carried out at TK ABA 06 with 20 children in one class and TK ABA 58 Surabaya with 17 children. In the implementation of this implementation begins with opening activities then core learning and closing. In the core activity, the teacher scans the QR Code to be displayed to the child through the LCD. After that the teacher asks questions related to animals that have been seen in the video. Then the children are invited to open the QR Code-based book and do the activities in the book.

After the activity is complete, the researcher tests the results of the implementation of the QR Code-based book through the results of the assessment that has been carried out by the teacher. Small group trials were given to children aged 5-6 years at ABA 58 Surabaya Kindergarten with a total of 17 children. This small group trial stage aims to determine the effectiveness and achievement of goals and also the initial response to the product developed. From the results of this small group trial, researchers saw that children really liked and were enthusiastic about learning using QR Code-based books. The data from the small group trial results are presented in table 3 and table 4 is the result of a large group trial conducted at ABA 06 Kindergarten with 20 children.

Table 3. Data from the Small Group Trial

Answer	Question Item										Total	%
	1	2	3	4	5	6	7	8	9	10		
Yes	15	16	16	14	14	15	15	14	13	14	146	85,88
No	2	1	1	3	3	2	2	3	4	3	24	14,11
Total	17	17	17	17	17	17	17	17	17	17	170	100

Table 4. Data from the Large Group Trial

Answer	Question Item										Total	%
	1	2	3	4	5	6	7	8	9	10		
Yes	18	17	17	20	20	20	20	20	19	19	190	95
No	2	3	3	0	0	0	0	0	1	1	10	5
Total	20	20	20	20	20	20	20	20	20	20	200	100

Based on the results of the analysis of small group trials of 17 children aged 5-6 years at ABA 58 Surabaya Kindergarten using QR Code-based books to develop children's cognitive development, the trial results showed that most (86%) gave yes answers and only a small proportion (14%) answered no. So, it is said that the QR Code-based book is very good to use and can be continued to the field test stage of the Large Group Test. So, it can be said that the QR Code-based book is very good to use and can be continued to the Large Group Test field test stage. After conducting a small group test and obtaining feasibility results for a large group trial, a large group test was carried out at TK ABA 06 with a total of 20 children. The results of the large group trial related to the application of QR Code-based books to develop children's cognitive development are that most (95%) gave the answer yes and only a small proportion (5%) answered no. Referring to this data, the results of the large group test are the same as those of the small group test. Referring to these data, the results are classified in the very good category.

Evaluation

The final product produced from this research is a QR Code-based book to develop cognitive development. This final product has gone through several revisions by media and material experts. Revisions made based on expert input are the basic colour of the book, sound, music, and work instructions.

After the activity was completed, the researcher tested the results of implementing a QR Code-based book through the results of the assessment that had been carried out by the teacher. The assessment is based on the cognitive development indicator instrument so that the assessment can be objective (Novitasari, 2018). In Kindergarten ABA 06, it was shown that 80% of children received good category ratings, then in TK ABA 58 Surabaya, 85% of children received good categories. So it can be concluded that QR Code-based books show proper use in developing cognitive development. In this activity, the development that will be stimulated is cognitive development such as counting the number of animals, connecting objects, recalling animals that have been seen in the video (Blankson & Blair, 2016; Garrison et al., 2001; Syukron Al Mubarak & Amini, 2019).

The results of this study refer to previous research conducted by (J.-K. Lee et al., 2011; M. Lee & Yeo, 2014) which stated that the application of the QR Code in learning makes it easy for teachers to adjust to class needs. QR Code allows users to embed various types of information (Kusumaningtyas & Hakim, 2020), such as text, images, videos, links about teaching materials, which can also facilitate learning inside and outside the classroom (Mowafi & Abumuhfouz, 2021; Pérez-Sanagustín et al., 2016). This QR Code-based book is also a novelty in the application of learning in early childhood education institutions, especially in ABA Surabaya Kindergarten, so that in practice children are interested and enthusiastic about

the products being developed. This is also supported by research results from the use of the QR Code in learning showing an interactive and fun learning experience for children (Mowafi et al., 2019). Research conducted by (Mahoney & Hall, 2017) shows that the use of the QR Code can increase children's independence in learning, the use of the QR code also makes it easier for students, educators, and parents in learning activities (Davidse et al., 2011; Oh-Young, 2022).

Cognitive development is the most important part of child development because all information is assimilated through cognitive development and this development can be stimulated through interactive video and knowledge video activities (Aulia et al., 2022). The results of the small-scale and large-scale trials also showed a very good percentage level by users, this is in accordance with research previously conducted by (Utami et al., 2021) which states that the use of Qr Code is effectively used to provide material understanding.

Conclusion

This research produces QR Code-based books to develop cognitive aspects of children aged 5-6 years. Based on the results of media and material expert validation, it shows that QR Code-based books have met the criteria to be developed. The results of the assessment of children's work also proved effective for developing cognitive aspects. This QR Code-based book can be a solution to the lack of maximum information conveyed by the teacher and can develop cognitive development (connecting and classifying) for early childhood. Suggestions for further researchers can continue the QR Code-based book with other themes and test it to a wider group.

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