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Development of Pop-Up Book Learning Media Assisted by QR Code to Increase Student Learning Motivation in Science Material

Elga Yanuardianto[1], Muhammad Ilyas[2], Muhamad Ali Wafa[3]
[1,2&3]Universitas Islam Jember, Indonesia

elgayanuardianto1987@gmail.com

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ABSTRACT
The use of appropriate learning media and in accordance with the needs of students, will create an active and fun learning atmosphere for students. This research and development produces learning media in the form of Pop up books assisted by Qr codes can be an effort to create an active learning atmosphere and can increase student learning motivation in the classroom. The purpose of this study was to analyze the ADDIE model in the development of Science Learning media With Pop Up Book Media assisted by Qr Code on the material of plant parts. The type of research used is research and development model with ADDIE model implemented until the implementation step. The results of this study show that; 1) the development Model of Pop-up Book Learning Media assisted by Qr Code in increasing student learning motivation, namely the results of Pop-up Book in Qr Code there is a video along with an explanation of the material. Developed products meet the components as teaching materials in learning. 2) P and feasibility test of the results of the development of Pop-up Book Learning Media assisted by Qr Code in increasing student learning motivation is carried out through media experts, material experts.

INTRODUCTION

The current state of education faces numerous challenges that hinder the achievement of desired outcomes, with many schools struggling to create environments that foster students' religious values, self-discipline, intelligence, moral character, and essential life skills (Sisdiknas, 2003; Pala, 2011; Darling-Hammond & Cook-Harvey, 2018; Abdullah et al., 2023). Teaching practices intended to encourage role modeling, perseverance, and creativity often fall short, creating a gap between educational objectives and classroom realities. This underscores the need for efforts to ensure education meets policy standards and leads to sustainable improvements in learning quality and student development (Altbach & Knight, 2007; Bengtsson et al., 2018; Al-Jaber & Al-Ghamdi, 2020). Natural Science (IPA) emphasizes studying natural phenomena and their links to human life through scientific inquiry, engaging students in exploration and experimentation to deepen understanding based on empirical evidence (Asih & Eka, 2015; Husamah et al., 2001; Wulandari, 2016). Media, as a non-verbal communication tool, plays a crucial role in education, significantly enhancing learning outcomes when used effectively. Given the varied characteristics of media, careful selection is essential to optimize its use in the learning process (Supriyono, 2018; Wahid, 2018).

Based on the needs analysis at MI Malik Ibrahim, it was found that science teachers predominantly use lecture methods and conventional media like textbooks. While teachers recognize the importance of learning media for understanding challenging concepts, current approaches such as question-and-answer sessions and collaborative learning games have not significantly improved student outcomes, especially in topics like plant structure (Cheung & Ng, 2021; Fonseca et al., 2023;

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Bach et al., 2023). Students often struggle to visualize concepts, leading to passive engagement and a monotonous learning atmosphere. To address these challenges, researchers propose using an interactive pop-up book with dynamic illustrations that engage students more effectively (Alviolita & Huda, 2019; Anggraini et al., 2019). Enhanced with QR codes, this pop-up book provides easy access to supplementary videos and materials, aiming to make the learning process more interactive and improve students' understanding of the subject matter (Ukhtinasari et al., 2017; Komari et al., 2022).

Based on the narrative above, the research aims to develop and implement an interactive learning medium in the form of a pop-up book enhanced with QR codes to improve the effectiveness of science education, particularly in topics related to plant structure. The primary objective is to create an engaging learning tool that not only helps students better understand complex concepts but also encourages active participation in the learning process (Chin et al., 2015; Limanto et al., 2020; Widarini et al., 2022). By integrating dynamic illustrations and QR codes for easy access to supplementary videos and materials, the research seeks to address the limitations of traditional lecture-based methods and make learning more interactive. The benefits of this research are multifaceted. Firstly, it aims to enhance students' comprehension of scientific concepts by providing a more tangible and visual representation of the material, thus aiding in the visualization of abstract topics. Secondly, the use of interactive media is expected to increase student motivation and engagement, making the learning experience more enjoyable and less monotonous (Hernández et al., 2019; Shapsough & Zualkernan, 2020; Astra et al., 2020). Thirdly, by incorporating QR codes, the research introduces a modern approach to accessing additional resources, allowing students to explore content beyond the classroom. Ultimately, this study seeks to contribute to improved learning outcomes in science education by fostering a more dynamic and student-centered approach to teaching.

Based on the research conducted so far, a preliminary conclusion can be drawn that the use of an interactive pop-up book enhanced with QR codes presents a promising approach to improving science education, especially on topics such as plant structure. The integration of dynamic visual elements and easy access to supplementary digital content addresses some of the limitations associated with traditional lecture-based teaching methods. This interactive approach not only helps students better visualize and understand complex concepts but also increases their engagement and motivation during the learning process. The findings suggest that when learning materials are presented in a more engaging and accessible manner, students are more likely to participate actively and achieve better learning outcomes. Therefore, the development of innovative learning media like the QR code-assisted pop-up book has significant potential to enhance the quality of science education and should be further explored and refined.

RESEARCH METHODS

The research to be conducted is of a Research and Development (R&D) type, which involves a systematic and logical process of data collection and analysis to achieve specific objectives (Sukmadinata, 2011). This approach originates from curiosity or identified problems, followed by a review of relevant theoretical foundations from the literature, which are then interpreted and applied in efforts to develop new solutions. Development research aims to establish growth patterns, identify changes, and create new designs. Unlike traditional research, it focuses on the development and production of new products, testing the effectiveness of existing products, and refining new creations through repeated field testing and revision until satisfactory results are achieved (Sugiyono, 2013; Sidiq & Najuah, 2020). In this study, the R&D approach will be utilized to create and improve learning media in the form of a pop-up book enhanced with QR codes, specifically designed for teaching the parts of a plant. This educational media aims to provide an interactive and engaging learning experience by incorporating dynamic visuals and accessible digital content via QR codes, which can help students better understand the subject matter. The development process will involve creating the pop-up book with integrated QR codes and then presenting and testing the media on 4th-

grade students at MI Malik Ibrahim Jenggawah, Jember. The effectiveness of the pop-up book as a learning tool will be evaluated based on its impact on student engagement, comprehension, and learning outcomes. Feedback from the field tests will guide further revisions and improvements to ensure the learning media meets the educational needs of the students effectively.

Developing learning media requires developing development models to ensure the quality of teaching materials to support learning effectiveness. This study adapts the ADDIE development model through five stages (Analysis, Design, Development, Implementation, Evaluation). (Srikandika et al., 2021) The development flow is shown below:

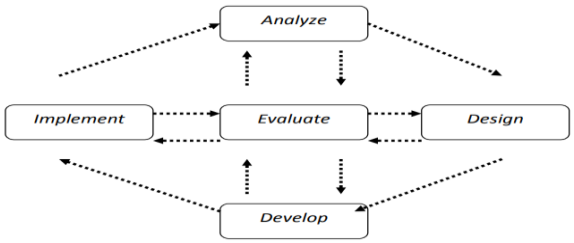


Figure 3. 1 ADDIE's approach to product development (Tegeh, 2014)

This study uses the ADDIE development procedure. Researchers wait until the implementation stage because there is limited time and adjusting to the purpose of the study, so researchers only conduct research until the validity test stage and the student's response to the learning media that has been developed namely Pop Book. If done until the evaluation stage, it will bring up new products, so researchers choose the implementation stage.

Research and Development Procedures

Researchers utilized the ADDIE model to guide the development process of creating a pop-up book learning media focused on the topic of plant parts for 4th-grade students at MI. The ADDIE model consists of five key stages: 1) Analysis, 2) Design, 3) Development, and 4) Implementation. These stages were followed systematically to ensure the effective creation and refinement of the learning media. To evaluate and refine the pop-up book assisted with QR codes, product trials were conducted to gather data. This data served as a reference for assessing the learning media's feasibility and making necessary improvements. The key aspects addressed during the product trials included: 1) Trial Design, 2) Selection of Test Subjects, 3) Data Sources, and 4) Data Collection Instruments. These elements were essential for obtaining comprehensive feedback on the product's performance and suitability for educational use. Data collection instruments in the research are expert validation questionnaires and response questionnaires of learners. The questionnaire used in this study is a checklist with a score assessment on each aspect using a Likert scale. Rating scale criteria used as follows: (Sugiyono, 2019)

Table 3.2 Rating Scale Criteria

Criteria	Scale
Strongly Agree (SA)	5
Agree (A)	4
Doubtful (D)	3
Not Agree (NA)	2
Strongly Disagree (SD)	1

Data analysis techniques in this study include data analysis results of expert validation, user validation, and analysis of learners ' responses. The Data were analyzed using quantitative data analysis techniques to determine the level of validity of the products developed, with the following details:

a. Data Analysis of Validation Results

Data analysis of validation results aims to determine the level of validity of media products developed in the form of Pop-Up Book Science Learning media assisted by QR Code. In determining the value (%) validation criteria using the following formula: (Akbar, 2017)

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

Description:

V(ah) = expert validation

Tse = total empirical score (expert assessment)

Tsh = total expected score

b. Practitioner outcome data analysis

Data analysis results practitioners (test the application of the model in learning) can use the following formula:

$$V(pg) = \frac{Tse}{Tsh} \times 100\ \%$$

Description :

V (pg) = expert validation

Tse = total empirical score (expert assessment; teacher)

TSh = total expected score

The validation criteria of learning media were developed as follows: (Akbar, 2017)

Table 3.3 Criteria Validation

Validation Criteria	Validation Level
85,01%-100,00 %	Very valid, can be used without revision
70,01-85,00 %	Quite valid, usable but needs minor revisions
50,01-70,00 %	Less valid, it is recommended not to be used because it needs to be revised
01,00-50,00 %	Not valid, cannot be used

c. Data analysis of the response of students

This analysis aims to determine the response of learners to learning media that have been developed. In determining the value (%) validity criteria using the following formula:

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

Keterangan:

V(au) = validasi audience (siswa)

Tse = total skor empirik (siswa)

TSh =total skor yang diharapkan

Response criteria of students to learning media developed as follows: (Akbar, 2017)

Table 3.4 Learner Response Criteria

Validation Criteria	Levels Of Validation
81,00-100,00 %	Very valid, can be used without revision
61,00-80,00 %	Quite valid, usable but needs minor revisions
41,00-60,00 %	Less valid, it is recommended not to be used because it needs to be revised
21,00-40,00 %	Not valid, cannot be used
00,00-20,00 %	Very invalid, should not be used

The learner response criteria in Table 3.4 provide a structured framework for assessing the validity of educational materials, such as the pop-up book learning media with QR codes. These criteria categorize the results into five levels of validation based on percentages obtained during the evaluation process, which guide decisions about the usability of the product and the need for revisions. A score in the range of 81.00-100.00% indicates that the learning media is "very valid" and can be used without further revisions, meeting the required standards for

educational use. For scores between 61.00-80.00%, the media is considered "quite valid" and usable, but it may benefit from minor adjustments to enhance its effectiveness. In the 41.00-60.00% range, the product is deemed "less valid" and should not be used in its current form, as it requires significant revisions to address any gaps or issues that could hinder the learning process. When the score falls between 21.00-40.00%, the media is categorized as "not valid," indicating that it is unsuitable for use and necessitates substantial changes due to major flaws impacting its effectiveness. Lastly, scores within 00.00-20.00% reflect that the media is "very invalid" and should not be used in any educational context, as it contains critical deficiencies that render it ineffective. This evaluation framework ensures that the learning media undergoes appropriate refinement to meet educational standards and support effective learning outcomes.

RESULTS and DISCUSSION

This research and development resulted in spesikfikasi pop Book Learning media assisted by QR Code on plant parts in MI Malik Ibrahim Jenggawah Jember as follows:

Learning Media Development Model Pop-Up Book assisted by QR Code in improving student motivation

The development of this learning media adapts to the ADDIE model developed by Made Tegeh, with the following stages: analysis (Analysis), design (Design), development (Development), implementation (implementation), and evaluation (evaluation). However, this study has yet to reach the implementation stage due to time constraints. The data research results are as follows:

Analysis

This stage is the first step in research. Analysis activities are carried out by performance analysis, needs analysis, and KI and KD analysis. As for the activities at this stage, they produced the following data:

a. Performance Analysis

The performance analysis included interviews with science teachers and Grade 4 students, MI Malik Ibrahim. The interview activity with the science teacher, held on December 04, 2022, obtained the results of science learning, especially the material of plant parts, which many students found difficult. Many are made demands by students so that they consider the material to be complex because of the limited teaching materials available. Thus, it can make understanding the material parts of plants difficult. The learning Media used in the daily learning process is LKS books, so it can lead to a lack of involvement of learners in learning and make the material presented less fully conveyed.

The results of interviews with ten 4th grade students MI Malik Ibrahim Jember, which were held on December 05, 2022, found that learning science was considered difficult as the material of plant parts needed teaching materials or other supporting media that could involve students in learning so that it was easy to understand the material.

b. Needs Analysis

The needs analysis questionnaire was distributed to 30 4th-grade students, including MI Malik Ibrahim Jember. From the results of the needs analysis that 93% of students need learning support media, 25% of students are not familiar with Pop Book Learning media assisted by QR Code, 93% of students expect learning media such as videos and pictures, 98% of students are interested in learning media related to technology, 98% of students agree with the existence of learning support in the form of Pop up Book Learning media assisted by Qr Code. With the details of these data, students are more interested in learning newer and more exciting press than the previous supporting learning media.

c. KI and KD analysis

This KI and KD analysis aims to compile material in the pop-up book media assisted by a QR code. KI and KD are prepared based on curriculum 2013 Revised Edition 2017 following the curriculum applied by the school.

Design

The second stage of this development aims to develop teaching materials to increase learners' interest so they feel happy with the generated learning media. This stage includes preparing learning materials, media selection, and initial design. The details are as follows:

a. Preparing Learning Materials

Learning materials are presented in the learning media by reviewing KI and KD. The material to be studied is the material parts of plants.

b. Media selection

The media was developed as a media pop book assisted by a QR code on the material of plant parts. The selection of media is tailored to the needs of learners. Pop-up Book Learning Media, assisted by QR code, can be used as teaching materials to support learning activities that can be used individually. Pop-up book Media utilizes paper materials and QR codes. Inside, the QR code displays several plant parts—the whole design part of the media pop-up book assisted with pure code created by researchers.

c. Early planning

In the initial design of the preparation of the product before being tested by preparing the plan of Learning media and instruments, including the following:

1) Media format Design

The initial design of the media is done by arranging the initial order of the Pop-up Book media Design assisted by a QR code on plant parts. The table makes the initial order of QR code-assisted Pop Up Book media on plant parts material.

2) Preparation Of the Instrument

Instruments designed at this stage include the needs analysis questionnaire instrument, media expert validation instrument, material expert validation instrument, user validation instrument, and learner response test instrument. The preparation of instruments adapted from the book Sa'dun Akbar BNSP (National Agency for Professional Certification) standards and other references that are in line with the developed teaching material products.

Development

In this development phase, several things are done, including the following:

a. Material Expert Validation

Assessment of Pop-Up Book material assisted by QR Code to material experts aims to determine the feasibility value of the material. The expert evaluation of the material was carried out by a tarbiyah lecturer at Islam Jember University, namely Mely Agustia, S.Pd., M.Pd., on February 06, 2023. The percentage shows a figure of 87%, with the material's feasibility level being very valid. So, the Pop Book Science Learning media, assisted by the QR Code that has been developed, is feasible to use without any revision. The following equations and calculations obtain the percentage value:

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

$$Vah = \frac{79}{90} \times 100\ \% = 87\%$$

b. Media Expert Validation

Assessment of Pop Up Book Media assisted by QR Code on expert value aims to determine the validity and accuracy of the material based on media Design, in terms of media appearance or design, and its application. Media expert assessment was conducted by the Tarbiyah Islamic University of Jember, Prima Cristi Crismono, S.Pd., M.Pd. on 06 February 2023. The final percentage results showed a figure of 87%, with the level of feasibility of learning media presented as very valid. So, the Pop Up Book media, assisted by the QR Code that has been developed, is feasible to use without revision. The following equation and calculation obtain the value:

$$V(ah) = \frac{Tse}{Tsh} \times 100\ \%$$

$$V(ah) = \frac{80}{90} \times 100\ \% = 88\%$$

c. Practitioner Validation

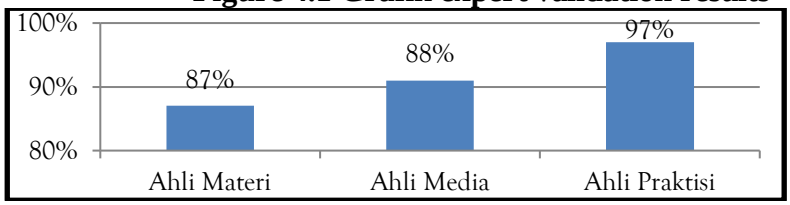
Assessment of QR Code-assisted Pop Up Book media to practitioners aims to determine the value of QR Code-assisted Pop Up Book media in terms of plant material and media design. The practitioner assessment was conducted by Zainullah Amin S, Pd. as a 4th grade science teacher, MI Malik Ibrahim. It was done on February 08, 2023. Practical validation instruments include material suitability, learning aspects, and language aspects. From the final result, the percentage shows 97%, with the criteria for the feasibility of the material and media presented being very valid. So, the Pop Up Book media, assisted by the QR Code that has been developed, is feasible to use without revision. The following equation and calculation obtain the value:

$V(ah) = \frac{Tse}{Tsh} \times 100\ \%$

$V(ah) = \frac{88}{90} \times 100\ \% = 97\ \%$

The product validation chart from the experts is as follows:

Figure 4.1 Grafik expert validation results



Implementation

The implementation phase is a continuation of the development phase. At this stage, several experts have developed and validated the entire learning media design, including material experts, media experts, and users. After going through the next revision stage, learners test it. The trials were conducted as follows:

a. Small-Scale Product Trials

The first product trial, which is a small-scale trial, aims to determine the validation of learners ' responses to QR Code-assisted pop-up Book media. This questionnaire was filled out by 10 students from Class 4 of MI Malik Ibrahim on February 09, 2023. The percentage results show that the overall response of learners is 90%. Judging from the percentage of Pop Up Book Media assisted by QR codes, it can be said to be very valid. So that the Pop Up Book media, assisted by the QR Code that has been developed, can be used for large-scale tests. Percentage results obtained by equations and calculations are as follows:

$V(au) = \frac{Tse}{Tsh} \times 100\ \%$

$V(au) = \frac{543}{600} \times 100\ \% = 90\%$

b. Large-scale product trials

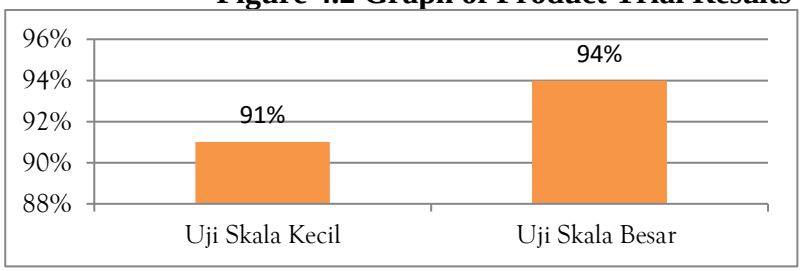
The following product trial was carried out: a large-scale test, this trial was carried out aimed at determining the validation of students ' responses to Pop Book media assisted by QR Code filling out this questionnaire was carried out by 30 students from Class 4 MI Malik Ibrahim on February 11, 2023. The percentage results showed that the overall response of learners was 94%. They reviewed the presentation of Pop Up Book Media assisted by QR Code. So, the Pop Up Book media, administered by the QR Code that has been developed, can be used to learn science material on plant parts. Percentage results obtained by equations and calculations are as follows:

$V(au) = \frac{Tse}{Tsh} \times 100\ \%$

$V(au) = \frac{1.709}{1.800} \times 100\ \% = 94\ \%$

The Grafik Darsi product trial results of students are as follows:

Figure 4.2 Graph of Product Trial Results



Feasibility test of the development of Pop-Up Book Learning Media assisted by QR Code in improving student learning motivation

Feasibility testing of the developed media is done by providing an overview of the data generated by several experts, such as material experts, media experts, practitioners, and response learners. The explanation of some of these experts is as follows:

Analysis of the Results of The Material Expert Trial

The material expert said that the presentation of the material in the material component is included in the perfect category, where the description of the material presented follows the competencies and objectives that must be mastered by students, as well as the completeness of the material with the Pop Up Book assisted by Qr Code is included in the perfect category. Thus, the media presented can encourage students' learning motivation in the learning process so that manageable levels of success in learning can be achieved. This statement is supported by previous research that says teaching materials in the learning process can facilitate learners in improving their understanding of concepts, motivate learners to learn, visualize learning materials to be more natural, and make the classroom atmosphere not monotonous (Mukswadini, 2020).

Material experts say that the presentation of the material on the component of the suitability of the dish with learning centered on students, including the category of very good, the feature covers several things that encourage students to learn in groups and can encourage students to practice reading content (soft skills). In the Learning media presented, a QR code can support students in learning individually or in groups. It can value soft skills that can improve the characteristics of students ' attitudes after learning the material presented. This statement is supported by previous researchers who said that evaluating the results of students' learning process, repeating the fabric, and stimulating the interest of students to conduct group discussions. Soft skills are self-development of a positive attitude, communication skills, and good personality skills. The delivery of soft skills in learning can instill a mindset in students to be pleasant people, socialize well, overcome conflicts, and develop an attitude of friendliness and concern for fellow beings (Mufanti, 2016).

In the aspect of language, material experts say that sentences used benefit communication in the category of good, the language of the use of terms and the preparation of sentence structure following the rules of the Indonesian tongue of good, sentences used following the understanding of learners, effective and does not cause double meaning in the very good. This statement is supported by previous researchers who say the use of grammar in teaching materials must use precise language, straightforward sentences, and short and can be read easily. Thus, the preparation of teaching materials must consider the readability criteria in the teaching materials to be presented (Yulia et al., 2021).

Analysis Of the Results of The Media Expert Trial

Media experts said that in the aspect of media form, the display of the attraction of the combination of colors and the production of IPA Pop Up Book media assisted by a simple QR Code, the proportional size of the press, and the arrangement of the media design are very well categorized media presented following the characteristics of learners. Regarding media quality, the Learning media can be used for a long time accompanied by instructions for use, making it easier for users to use the media. In addition, the ease of the Science Learning Media Pop-Up Book assisted by QR Code can increase the interest of students so that students can interact directly with the media presented (Rahim et al., 2019). Thus, the media's ease of use will be feasible for learning. This

statement is supported by previous researchers who said ease of use in learning media can be used to measure success in making the media (Buabeng-Andoh, 2018; Posumah, 2021).

In the function of the learning media presented to make learners more active, the press explained the image following the learning materials, which are categorized very well. In the aspect of QR Code Media text harmony, the video presented in the media can increase the sense of pleasure in students who are categorized as very good; this statement is supported by previous researchers who say suitable teaching materials are shown with a sense of fun and enthusiasm from students when using these teaching materials (Astuti & Prabowo, 2020; Kamarulzaman et al., 2021).

Analysis Of Practitioner Trial Results

In the aspect of suitability of the material, the teacher said that the material presented following the learning objectives in the category is perfect, the material presented following the characteristics of the learners is excellent, the material presented is complete and systematic in the class is very good, and the suitability of the example with the material is excellent. The statement is supported by previous researchers who stated the practicality of learning materials, the suitability of the material with the applicable concepts, the presentation of the material, the relationship of the material with the learning objectives, and the completeness of the fabric following the development of students can make it easier for students to understand the material so that the (Mahesti & Koeswanti, 2021).

Regarding language suitability, the teacher said that the use of language in the category is perfect, the selection of sentences can invite students to interact with the media in the class, and the writing presented in the media read in the category is very good. In the QR Code component, the teacher said that the QR Code contains several lessons that are used to access video material on plant parts and explanations of plant parts that are categorized very well. This statement is supported by previous researchers who said that using QR code media can access learning materials linked to websites and links that researchers have compiled.

Analysis of response Data Peserata Didik in large and small scale

Aspects of the attractiveness and practicality of the learning media used are enjoyable and exciting, with the number of items 12 statement score 543 percentage 90% in the category of very valid. On the value of perspex form of media presented as attractive got a score of 88%, Pop up Book Science Learning media assisted by QR Code on the parts of the plant offered following the material got a score of 88%, the material presented a score of 85%, the material delivered a score of 90% quickly, the material had coherently score of 85%, the accuracy of the delivery of the material score of 90%, coverage into the material clearly score of 93%, the display of Science Learning media assisted by Qr Code simple and enjoyable score of 93%, the size of the proportional Learning media score of 93%, arrangement on the design of Learning media balanced score of 90%, Learning media can be used easily score of 90%. Based on these data, the average learner responds positively to the media used.From the results of the small group trial, learners obtained a percentage of 90%. Based on Table 4.7, the value is in a very valid category, located in the 81.00% -100.00% range. Based on the results of the learners 'responses, it can be concluded that the Pop Up Book Science Learning media assisted by QR Code plant parts is “very interesting" to continue research in large group trials.

While the analysis of the test results of large-scale learners, namely aspects of the attractiveness of the learning media used, is entertaining and exciting with the number of items, 12 statements get a score of 1,709 percent 94% in the category of very valid, the value per an aspect of the form of media presented attractive get a score of 88%, Pop up Book Science Learning media assisted by Qr Code on the parts of the plant presented in accordance with the material get a score of 90%, the material presented is the clear score of 85%, the material presented is the easy score of 83%, the material presented is the coherent score of 85%, accuracy of material delivery score 90%, coverage into the material score 93%, display of Science Learning media Pop Up Book assisted Qr Code simple and attractive score 93%, the size of the Learning media proportional score 93%, the arrangement of the design of Learning media balanced score 90%, Learning media can be used easily score 90%. Based on these data, the average learner responds positively to the media used.

The learners' response percentage was 94% from the extensive group trial results. Based on the conversion table, the value is included in the very valid category, located in the 81.00% -100.00%. Based on the learners ' responses, it can be concluded that the pop-up Book Science Learning media assisted by QR Code on plant parts at the MI/SD level is “very interesting” to be applied as a learning media.

Product Revision Review

Based on the above analysis, the Pop Up Book media assisted by QR CODE in the media category is feasible or false to be developed. Still, researchers make minor revisions as a form of advice from the validity of media experts. Suggestions from the validity of media experts aim to improve the display of media in pop books assisted by QR codes to be more efficient and attractive to learning media, while the findings of this study, among others;

Development of Science Learning Media

The development of pop-up books and Science Learning media assisted by QR codes makes learning more interesting because it can combine learning media with technology. In media form, the attraction of the combination of colors and the display of IPA Pop Up Book media assisted by a simple QR Code, proportional media size, and arrangement in media design are very well categorized—media presented in accordance with the characteristics of learners. Regarding media quality, the Learning media can be used for a long time accompanied by instructions for use, making it easier for users to use the media. In the function of the Learning media presented to make learners more active, the press presented explains the image in accordance with the learning materials and is categorized very well.

Feasibility Test Of Expansion Results

Pop-up Book Learning Media assisted by QR Code has been through the validity of the media and materials by experts. The material expert said that the presentation of the material in the material component is included in the outstanding category, where the description of the material presented is in accordance with the competencies and objectives that must be mastered by students, as well as the completeness of the material with the Pop Up Book assisted by Qr Code is included in the outstanding category, thus the media presented can encourage students ' learning motivation in the learning process so that manageable levels of success in learning can be achieved. This statement is supported by previous research that says that teaching materials in the learning process can make it easier for students to improve their understanding of concepts, motivate students to learn, visualize learning materials to be more accurate, and make the classroom atmosphere not monotonous (Mukswadini, 2020; Javaid et al., 2023).

Media experts said that in the aspect of media form, the display of the attraction of the combination of colors and the production of IPA Pop Up Book media assisted by a simple QR Code, the proportional size of the press, and the arrangement of the media design are very well categorized—media presented in accordance with the characteristics of learners. In the aspect of QR code Media text compatibility, the video shown in the media can increase the sense of pleasure in students who are categorized as very good; the statement is supported by previous researchers who say that suitable teaching materials are shown with a sense of pleasure and enthusiasm from students when using these teaching materials (Astuti & Prabowo, 2020).

CONCLUSION

Based on the above exposure, it can be concluded as follows: First, the development of a Science Learning media Pop Up Book assisted by a QR code on the material of plant parts with the results of the QR CODE, there is a video along with an explanation of the material. Developed products meet the components of teaching materials in learning. Second, the development of the Science Learning Media Pop-Up Book was assisted by a QR Code on the plant parts' material. According to media experts, material experts are significant in providing a clear understanding of the material of plant parts.

The development of a QR code-assisted Pop-Up Book for science learning has both theoretical and practical implications. Theoretically, it supports multimedia learning theory by combining visual and auditory content to enhance understanding, and it validates the ADDIE model's effectiveness in instructional design. Practically, the interactive Pop-Up Book with QR codes offers a versatile tool for engaging students through hands-on activities and digital resources, making abstract concepts like plant parts more accessible. It also facilitates differentiated learning, allowing students to learn at their own pace while promoting digital literacy and increasing motivation, ultimately leading to improved science learning outcomes.

Future research should expand the use of QR code-assisted Pop-Up Books to other subjects to assess broader applicability and effectiveness across different learning contexts. Longitudinal studies could evaluate the impact on knowledge retention, while comparative research with other multimedia tools, like augmented reality, would help identify the most effective formats. Incorporating student feedback in the development process could align the media more closely with learners' preferences, and investigating its impact on different learning styles and abilities, including special educational needs, would offer insights into its adaptability. Additionally, exploring teacher training requirements for effective integration could ensure that educators are fully equipped to maximize the potential of these innovative learning tools.

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