QR Code-Practicum Guide Based on Guided Inquiry as The Novel Biology Lab Activities Learning Assisted

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Abstract: Educators play an important role in developing learning tools that are interesting and by the needs of students. This aims to develop a QR Code-Practical Guide based on Guided Inquiry for Class XII MIPA at the High School Level on growth and development in plants and photosynthesis and to determine the validity, practicality, and effectiveness. This type of research is Research and Development with the ADDIE model which consists of 5 stages, namely Analyze, design, development, Implementation, and evaluation. The research location is at SMAN 2 Majene, East Banggae District, Majene Regency, West Sulawesi Province. The research subjects were class XI MIPA 5 which consisted of 31 students. The results of the validation of the QR Code Practical Guide based on Guided Inquiry using the assessment sheet of media experts and material experts who were assessed by 2 expert validators obtained a result of 3.8 which is included in the valid category. The results of the practicality of the QR Code Practical Guide based on Guided Inquiry using teacher response questionnaires and student response questionnaires. The results of the questionnaire analysis show that the value of the teacher's response is 92.6%, getting the very practical category and the value of the student's response is 86.6% getting the very practical category. The results of the QR Code Practical Guide based on Guided Inquiry using test questions, the learning outcomes obtained are 80.7% in the effective category. Thus the QR Code Practical Guide based on Guided Inquiry is declared valid, practical, and effective to be used as teaching materials.

Keywords: ADDIE; Biology lab activities; Guided inquiry; QR code-practical guide

Introduction

Teaching materials are useful for helping educators in carrying out learning activities. For teachers, teaching materials are used to direct all their activities, while for students, teaching materials are used as guidelines used during the learning process (Sujana, 2020). Teaching materials can be used to oversee the process of obtaining student information in individual learning (Winarno et al., 2019). The types of teaching materials that can be designed or arranged by the teacher himself are examples of practicum guides (Ramadhan et al., 2020). The practicum guide can be used by students during practicum in the laboratory which is useful for facilitating teachers and students in the practicum process so that practicum objectives can be achieved (Muna, 2016). Good teaching materials will be supported by learning models to create a conducive learning atmosphere (Aprilia et al., 2020). The guided Inquiry learning model can be a solution for biology learning models to improve students' science process skills in learning biology itself (Supriyatno et al., 2020). The guided inquiry learning model is a learning process that begins with presenting questions or problems, making hypotheses, designing experiments, conducting experiments to obtain information, collecting and analyzing data, and making conclusions (Bago, 2018). The most important thing in teaching guided inquiry is the ability to organize the learning environment to facilitate student activities and provide sufficient guidance to ensure that every step of the activity can discover concepts

and principles (Sujana, 2020). Activities that can support the successful implementation of the learning process are not only related to learning models, but the use of technology today needs to be done to be able to make students not outdated (Yanti et al., 2020).

Looking at the current situation and conditions, the development of information technology is increasingly widespread, and the internet and smartphones cannot be separated from human life in all fields. Along with the development of information needs, various applications have emerged to access information via mobile phones (Rahmandani et al., 2018) and one that is considered practical is the Quick Response Code (QR Code) application (Agustini, 2021). QR Code is a two-dimensional matrix image that can translate stored data at high speed. The results of Saleh et al. (2018) at Makassar State University, for students majoring in foreign languages, show that the motivation to learn to use the QR Code has increased. In addition to increasing learning motivation, the use of learning media also increases student learning achievement (Salma, 2020). Although QR codes have begun to be used in textbooks at school, QR codes have never been integrated in a practicum guide, especially biology practicum. This is an innovative student friendly learning approach in the form of presenting a practicum guide that is digital, paperless, cheap, and easy to use.

According to the results of observations made at SMAN 2 Majene, information was obtained that there were students problems when carrying out practicum activities. One of the problems is that the teacher does not use a practicum guide in the practical activities of the subject, but only uses the student manual as a guide. Even though the student guidebook only contains tools and materials along with work procedures which are explained briefly, causing many students are confused about carrying out practicums. Practicum activities will certainly run efficiently and conductively if supported by practicum guides (Bago, 2018). Practicum guides play a role in developing students' scientific attitudes and performance (Furqan et al., 2016). To increase learning motivation and student learning outcomes, researchers are interested in developing a Guided Inquiry-based QR Code Practicum Guide which later can be applied by teachers who are expected to be able to help and also facilitate practicum activities in the laboratory for students so that the objectives of the practicum can be achieved. As well as students when carrying out practicum activities it becomes easier and can also help teachers in guiding and directing students so that the practicum process runs optimally. Therefore, this study aims to determine the validity, practicality, and effectiveness of the QR Code Practicum Guide based

on Guided Inquiry in biology subjects on growth and development and photosynthesis.

Method

The type of research is research and development (Research and Development) using the ADDIE model which consists of Analysis, Design, Development, Implementation, and Evaluation (Sari, 2018).
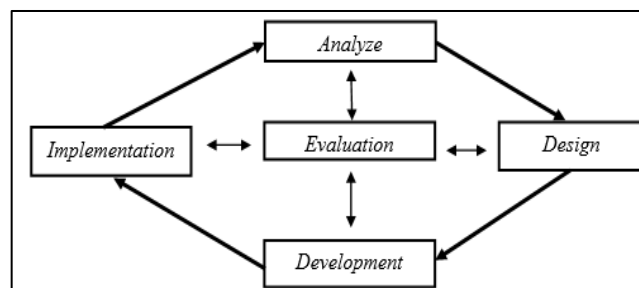

Figure 1. ADDIE model flowchart

The product resulting from this research is a QR Code-Practicum Guide based on Guided Inquiry. The research subjects were class XII MIPA 5 with a total of 31 students and 2 teachers in Biology class XII MIPA SMAN 2 Majene. The instruments used in this study included: (1) expert questionnaire validation sheets, practicality questionnaire validation sheets, and validation sheets for material experts and media experts; (2) teacher response questionnaires and student response questionnaires were used to obtain data regarding teacher and student responses to the use of teaching materials QR Code Practicum Guide, and; (3) the learning achievement test is a tool used by researchers to measure students' mastery of the material that has been practiced by the teacher and measure the development of students learning progress. Validation data analysis, practicality, and effectiveness can be calculated using the formula

Validity Data Analysis
Data from the validation results of experts for each learning device were analyzed. The activities carried out in the process of analyzing data validity of learning devices, according to (Hartoto et al., 2021) tha recapitulate data from the results of the validity assessment of the QR Code Practicum Guide and instruments into a table that includes: (a) aspects (Ai), (b) criteria (Ki), (c) validator assessment results (Vij). Meanwhile, determine the average value of the validation results from all validators for each criterion with the formula 1, which the symbol $\bar{K}_i$ is the mean of criterion to i^{th}, $\bar{V}_{ij}$ is the average score of the assessment criteria for the ith criterion by the j-evaluator, and n is number of validators.

$$\bar{K}_\iota = \frac{\sum_{j=1}^{n} V_{ij}}{n} \quad (1)$$

a) Determine the average of each aspect with the formula 2, which the symbol is the mean of aspect to 1th, $\bar{K}_{ij}$ is the mean for ith aspect j-criteria, and n is number of criteria of ith aspect.

$$\bar{A}_\iota = \frac{\sum_{j=1}^{n} \bar{K}_{ij}}{n} \quad (2)$$

b) Determine the value of V_a or the total average with the formula 3, which the symbol V_a is the total average, $\bar{A}_i$ is the mean of aspect ith, and n is the number of aspect

$$V_a = \frac{\sum_{j=1}^{n}}{n} \quad (3)$$

c) The V_a value or total average value is referred to in the interval for determining the validity level of the media
   1) $1 \le V_a < 2$: invalid
   2) $2 \le V_a < 3$: less valid
   3) $3 \le V_a < 4$: quite valid
   4) $4 \le V_a < 5$: valid
   5) $V_a = 5$: very valid

Practicality Data Analysis
a) Determine the value of each answer
   Determination of value refers to the assessment guidelines according to Hartoto et al. (2021) as the Table 1.

Table 1. Questionnaire Assessment Guidelines

Answer	Value	
	Positive	Negative
Very good	5	1
Good	4	2
Quite Good	3	3
Not Enough Good	2	4
Not Good	1	5

b) Calculate the percentage of the average response value for each statement by formula 4.

$$\text{Percentage} = \frac{\text{Total score}}{\text{Maximum Score}} X\ 100\% \quad (4)$$

The percentage results obtained after performing calculations using the formula are then adjusted to the practicality assessment categories contained in Table 2.

Table 2. Category of Teacher and Student Practicality Assessment

Intervals	Category
81 – 100	Very practical
61 – 80	Practical
41 – 60	Quite Practical
21 – 40	Not Enough Practical
0 – 20	No Practical

Effectiveness Data Analysis
Analysis of the effectiveness of the QR Code-Practicum Guide data by using a learning achievement test. Student completeness is based on the Minimum Completeness Criteria (MCC) that have been set by the school. Students are said to be successful in learning if they obtain a minimum score of 77. According to Hapsari (2016), to determine the effectiveness of the developed QR Code-Practicum Guide can be calculated using the formula 5, which the symbol P is Percentage of students who complete CCM, x is The number of stundents who complete CCM, and y is the total number of students.

$$P = \frac{x}{y} X\ 100\% \quad (5)$$

Giving and making decisions about the effectiveness of the QR Code- Practicum Guide developed will use research qualification criteria based on Yusro et al. (2021) which is shown in Table 3. Each aspect of the percentage is categorized based on the test of learning outcomes analysis of assessment data is said to be effective if the interval is above 61%.

Table 3. The Effectiveness of Learning Outcomes Tests

Percentage (%)	Criteria
81 - 100	Very Effective
61 – 80	Effective
41 – 60	Quite Effective
21 – 40	Not Enough Effective
0 – 20	No Effective

Result and Discussion

The results obtained from this research and development are the QR Code-Practicum Guide based on Guided Inquiry which meets the valid, practical and effective criteria. The validation analysis results obtained can be described as in Table 4.

Table 4. Learning Outcomes Test Validation Results

Rated Aspect	Average Score	Result
Logical Validity	4.1	Valid
Advance Validity	4.1	Valid
Total Average	4.1	Valid

Table 5. Material and Media Expert Validation Results

Rated Aspect	Average Score	Result
Material Validity	3.8	Valid
Media Validity	3.9	Valid
Total Average	3.8	Valid

Table 6. Results Percentage of Average Value Per Category on the Teacher Response Questionnaire

Aspect	Average Score	Category
Practicum Guide Cover Design	90.0%	Very Practical
Appearance/Presentation of Content	100%	Very Practical
Material	90.0%	Very Practical
Video	90.0%	Very Practical
Usefulness	93.3%	Very Practical
Total Average	92.6%	Very Practical

Validation was carried out by 2 expert validators to assess the design and content contained in the QR Code- Practicum Guide that had been developed by the researchers. This validation aims to assess the level of validity of the product to be used as teaching materials in learning. Based on Tables 4 and 5, the results of the validation of the learning outcomes test are 4.1 and the validation of media and material experts is 3.8 which are in the valid category. The resulting QR Code-Practicum Guide display can be seen as Figure 1.
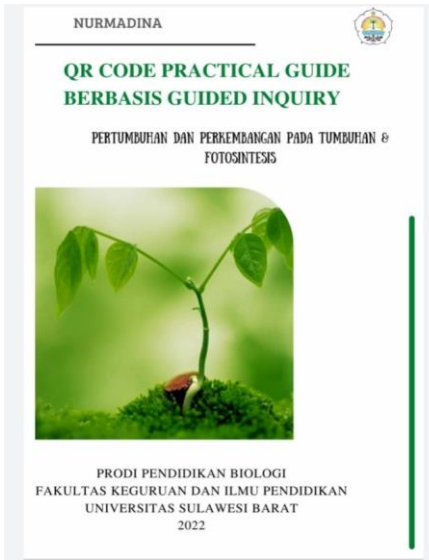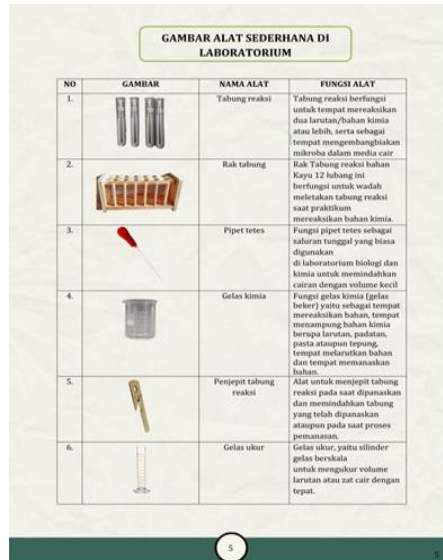

Figure 2. Practicum guide cover design
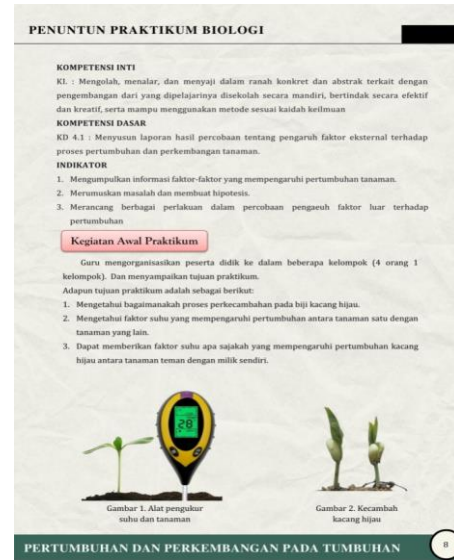

Figure 3. Types and functions of laboratory equipment

Figure 4. Learning objectives page

Figure 5. QR Code to access the first step of guided inquiry activity: (1) presents a problem
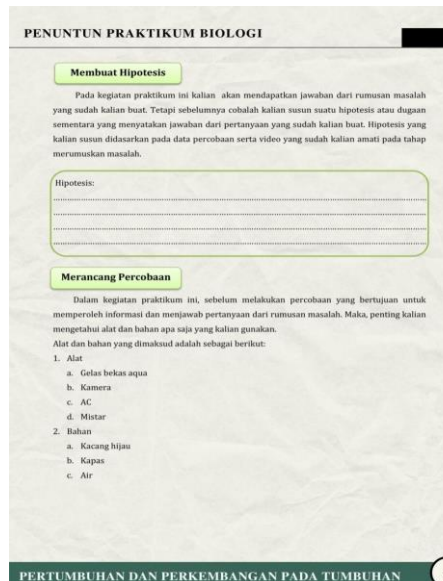

Figure 6. The second and the third steps of guided inquiry activity: (2) make a hypothesis and (3) designing an experiment
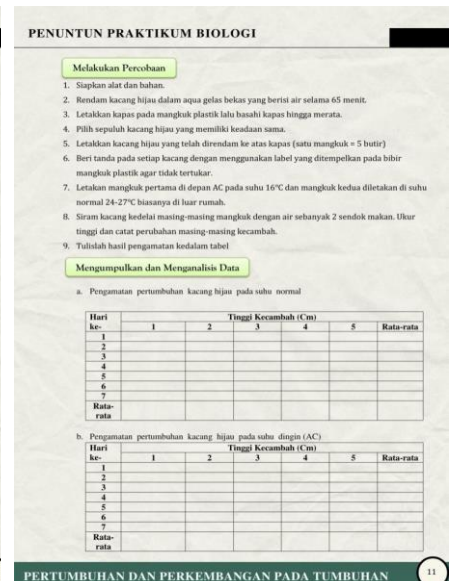

Figure 7. The fourth and the fifth steps of guided inquiry activity: (4) do an experiment and (3) collect and analyze data

Figure 8. The sixth step of guided inquiry activity: (6) make conclusions

Table 7. Results Percentage of Average Value per Category on the Student Response Questionnaire

Aspect	Average Score %	Category
Practicum Guide Cover Design	85.3	Very Practical
Appearance/Presentation of Content	88.1	Very Practical
Material	87.0	Very Practical
Video	87.0	Very Practical
Usefulness	86.0	Very Practical
Total Average	86.6	Very Practical

Teacher and student response questionnaires are used to assess aspects of Cover Desain, Appearance/Presentation of Content, materials, videos, and the usefulness. The teacher response questionnaire was given to the biology teacher at SMAN 2 Majene and the student response questionnaire was given to 31 students in class XII MIPA 5 SMAN 2 Majene. Giving this questionnaire aims to obtain data regarding the response of student teachers to the QR Code-Practicum Guide that has been developed by researchers. Based on the total average score obtained from the biology teacher it is in the score range of 81-100% with a P value (Percentage score) of 92.6% which is categorized as very practical or the QR Code assisted e-module developed is feasible to use while the calculation results overall student response questionnaire total average value is 86.6%. The score is in the range of 81-100% which is categorized as very practical (Hartoto et al., 2021), meaning that the QR Code-Practicum Guide is well used in biology learning.

Table 8. Results of Learning Outcomes Test Analysis

Category	Total	Completeness Percentage %
Complete	25	80.7
Not Complete	6	19.3

Based on the learning outcomes test that has been carried out in class XII MIPA 5, namely 31 people. Students who completed amounted to 25 people and those who did not complete amounted to 6 people. If a percentage is obtained that 80.7% of students fall into the complete category, 80.6% is in the range of 61 – 80%, which is included in the effective category. The teaching materials developed can be said to be effective because in practice there are things that support the achievement of research objectives, including (1) the developed teaching materials are adapted to the 2013 curriculum; (2) the process of practicum activities using the QR Code Practical Guide uses simple language, easy to understand and makes it easier for students to easily understand the material in the practicum; (3) the use of the QR Code Practical Guide helps students better understand each practicum unit because the QR Code-Practical Guide is equipped with a video presented in the QR code (Setiyawan, 2017).

Conclusion

All in all, it can be concluded that: the QR Code-Practicum Guide based on the Guided Inquiry developed is feasible to use. This can be seen from the average percentage obtained from the validation of media experts and material experts of 3.8 so it is categorized as valid. The response of the biology teacher at SMA Negeri 2 Majene to the QR Code-Practicum Guide based on Guided Inquiry with a percentage score obtained of 92.6% is very practical. The response of the students of Majene 2 Public High School to the Guided Inquiry-based QR Code-Practicum Guide with a score percentage obtained of 86.6% was very practical. The effectiveness of the QR Code-Practicum Guide based on Guided Inquiry for students was obtained at 80.7% so the QR Code-Practicum Guide based on Guided Inquiry was said to be effective.

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