

Development Module Based QR Code Utilization in Field Practices Invertebrates Zoology Course

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Abstract: This study aims to develop a QR Code-based module in its use in the field practicum of invertebrate species in the Invertebrate Zoology course in the form of the Invertebrate Zoology module. This type of research is development research using the ADDIE model. The research procedure consists of 5 stages, namely analysis, design, development, implementation, and evaluation. In this study, an assessment of the use of modules as learning media was used, the instruments used in the study were material validation questionnaires, media validation, practicality questionnaires, and student response questionnaires. The data collected were analyzed quantitatively and qualitatively. The results showed that the QR Code-based module on invertebrate species material in its use in the field practicum of the Invertebrate Zoology course was feasible to use based on the assessment of material I experts as much as 88% and material II experts as much as 80% and media experts 88.5% with a very valid category. , and 80% practicality data and 85% student response questionnaire. The development of learning media based on QR Code for Invertebrate species material in its use in the field practicum for the Invertebrate Zoology course is feasible to be used as a support for learning in the Invertebrate Zoology course.

Keywords: Development Module; Invertebrate Zoology; QR Code

Introduction

The observations carried out by field practicum activities for invertebrate zoology courses, it was found that several actions taken by research students that have the potential to damage the existence of marine biota occur because sometimes after conducting research on 1 or more types of marine biota they just leave the marine biota without returning it to their habitat beginning.

The development of technology and information is increasingly sophisticated and can be used as a more effective learning tool. According to Daryanto (2013) the module is in the form of printed teaching materials which are teaching materials that are arranged systematically and attractively which includes learning objectives, material content and evaluations that can be used independently (Sidiq et al., 2021). Modules can be interpreted as subject matter that is arranged and presented in writing in such a way that readers are expected to absorb the material themselves (Wulandari et al., 2022). The marine biota research method using a

QR Code-based module can be an alternative environment-based learning method (invertebrate zoological research methods without damaging the biota or the environment).

Seeing the above situation, the researcher wants to develop a QR Code-based module as a learning medium at the Puangrimaggalatung University Campus, Faculty of Teacher Training and Education, Biology Education Study Program. The QR Code-based module as a learning medium in the Invertebrate Zoology course, it is expected to increase knowledge and be effectively used by students.

The developed media is a QR Code-based module in the invertebrate zoology course for biology education students. The design components in the QR Code-based media are in the form of cover modules, front pages, instructions for use, material content that includes each species definition, classification of each invertebrate species, characteristics of each invertebrate species, reproduction of each invertebrate species, the role of each invertebrate species, and evaluation (Ningrum &

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Ambarwati, 2023). Then the QR Code is a draft of the contents of the Invertebrate Zoology module in the form of an image of each invertebrate species that is used as a barcode created using a QR Code Generator in the form of a module (Ramalho et al., 2020). The main purpose of QR Codes is currently used to access information by scanning barcodes on each invertebrate species according to the opinion Ataji (2019), which states that using QR Codes and smartphones applied in the classroom can provide many advantages such as illustrated and easy-to-use handbook suitable for student level. The next step in development research after the planning stage of learning media is the validation stage.

Method

Research Subject

The subjects in this study were students who programmed the Invertebrate Zoology course at the Biology Education Study Program, Puangrimaggalatung University. In this study, the learning media that will be taught are material classification, understanding, reproductive system, and the role of invertebrate animals, for biology education students in the fourth semester.

Location and Time of Research

Research on the development of QR Code-based learning media carried out at the Puangrimaggalatung University Campus, as research subjects, namely fourth semester students of biology education study program. This research took place from April 25 to May 9, 2022. The students studied in the fourth semester were 5 students. This research is carried out or taught directly by the researchers themselves.

Data Collection Instruments

The data collection instrument used to obtain a number of data is in the form of a validation questionnaire and a test of learning outcomes. The data collection used can be explained as follows:

Questionnaire

Questionnaires are used to collect data about the accuracy of the components of teaching media (Doyan et al., 2020), the accuracy of the design or learning design, the accuracy of the content of the teaching media, the attractiveness and effectiveness of the use of teaching media (Oktafia & Zainul, 2022).

The questionnaire used is a type of questionnaire that contains a rating scale. The rating scale questionnaire is a questionnaire that contains questions followed by columns indicating the levels. The questionnaires required are material expert

questionnaires, media expert questionnaires, and student response questionnaires through trials.

Research Procedure

The development procedure used in the development of the QR Code-based module as a learning medium uses the ADDIE development model (Pradiva et al., 2022). This model was chosen because it is generic and simple and its implementation is structured systematically, besides the ADDIE development model provides an opportunity to evaluate and revise every phase it goes through (Mahardika et al., 2023). The development steps used in developing the QR Code-based invertebrate species module in its use in the field practicum in the invertebrate zoology course refer to the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model (Badriana et al., 2021).

Data Analysis Techniques

There are data analysis techniques used to process data from the development results (Hamzah & Mentari, 2017), namely content analysis and descriptive analysis. This analysis was carried out by grouping analysis to formulate learning objectives of Invertebrate Zoology in invertebrate species based on basic competencies and to organize the learning content developed. The results of this analysis are then used as the basis for the development of QR Code-based learning media for Invertebrate species material in the Invertebrate Zoology course.

Descriptive Analysis

At the trial stage, data was collected using an assessment questionnaire (Bachtiar et al., 2022). The results of this descriptive analysis are used to determine the level of product feasibility resulting from the development of QR Code-based learning media on invertebrate species in the Invertebrate Zoology course. Data in the form of numbers will be analyzed by descriptive percentage, with the formula 1.

$$\text{wanted presentation} = \frac{\text{total answers of respondents}}{\text{highest number of answers}} \times 100\% \quad (1)$$

While the basis and guidelines for determining the level of validity and the basis for making decisions to revise teaching materials use the following qualifications.

Table 1. Media Eligibility Level Qualification

Percentage (%)	Validity Level Description
84-100	Very valid No revision
68-84	Valid No revision
52-68	Sufficiently valid Partial revision
36-52	Invalid Revision
20-36	Very less valid Revision

Based on the above criteria, teaching media are declared valid if they meet the criteria for a score of 80 out of all the elements contained in the material expert and media expert validation assessment questionnaire. In this development, the teaching media made must meet valid criteria. Therefore, a revision is made if it still does not meet the valid criteria. Data about student response questionnaires were analyzed by descriptive percentage test (Surani & Hamidah, 2020) with the formula 2.

$$P = \frac{f}{N} \times 100\% \quad (1)$$

Information :

P : expected score

f : total score obtained

N : the maximum number of scores

Table 2. Criteria of data presented is then recapitulated

Percentages (%)	Categories
76 - 100	very good
51 - 75	good
26 - 50	good enough
0 - 25	not good

Result and Discussion

This research and development resulted in a product in the form of a QR Code-based Invertebrate Species Module in its use in the Invertebrate Zoology Course Field Practicum and was developed with the ADDIE development procedure which consists of 5 stages, namely the analysis stage, the design stage, the development stage, the implementation stage, and the evaluation stage.

Analysis Stage

The analysis aims to examine Course Learning Outcomes, Sub-Course Learning Outcomes in achieving learning that applies in the Biology Education Study Program, Puangrimaggalatung University. Based on the results of observations made with 4th semester students of the biology education study program, it was found that most students still experience difficulties in field practicums in adjusting Invertebrate Zoology material including understanding, classification, characteristics, reproduction, and the role of each invertebrate species found. Another supporting reason is that in the 4th semester biology education study program, it is known that there is no QR Code-based module as a learning medium.

Design Stage

In the development media that have been compiled, namely QR Code-based learning media material for

invertebrate species for the Invertebrate Zoology course in the form of modules for fourth semester students of the Faculty of Teacher Training and Education, Puangrimaggalatung University.

Front page

The front page of this learning media contains the title, pictures of several invertebrate species, the author's name, and the name of the campus.

Competency details

In the details of the competencies in the instructions for use, there are basic competencies and learning objectives. The following is a display of basic competencies and learning objectives.

Contents

The content of the material on the QR Code-based media contains the definition, classification, characteristics, reproductive system, and the role of each Invertebrate species.

Evaluation

In the evaluation there is a summary of the material and 10 number multiple choice questions as a benchmark in understanding the material.

Biography

Contains the identity of the developer of QR Code-based learning media for invertebrate species in invertebrate zoology courses.

Development Phase (Development)

QR Code-Based Learning Media Validation on Invertebrate Species Material In Invertebrate Zoology Course. After the learning media has been designed, then the validation stage is carried out. The validation of learning media is validated by material experts and media experts. The material expert, namely Dr. Muhammad Nur, M.Pd and Dr. H. Muhammad Arafah, M.Pd, while the development experts are Muhammad Nasir, S.Pd., M.Pd. The assessment uses a questionnaire, which is a type of questionnaire that contains a rating scale.

Material Expert Validation by validator 1

Material expert validation is carried out with statements related to the Accuracy of Module Content, Module Manuals and Answer Keys, Module Language and Writing, Module Question Question Construction, then the material expert validator provides an assessment of QR Code-based learning media on its use in field practicum on eye invertebrate species. Invertebrate Zoology courses are in the form of modules.

The results of material expert validation by validator 1 can be seen in Table 3.

Table 3. Results of Expert Validation of Learning Media Materials by Validator 1

Parameters	Score (%)	Criteria
Module Content Accuracy	85	Valid
Module Guide and Answer Key	93	Valid
Language and Writing Module	93	Valid
Module Questions Construction	80	Valid
Average	88	Valid

Based on the results of the material expert assessment (validator 1) shown in Table 3, it shows that the QR Code-based learning media has referred to the valid category with an average value of 88%. The figures obtained indicate that this learning media can be used.

Material Expert Validation by validator 2

Material expert validation is carried out with statements related to the Accuracy of Module Content, Module Manuals and Answer Keys, Module Language and Writing, Module Question Question Construction, then the material expert validator provides an assessment of QR Code-based learning media on its use in field practicum on eye invertebrate species. Invertebrate Zoology courses are in the form of modules. The results of material expert validation by validator II can be seen in Table 4.

Table 4. Results of Expert Validation of Learning Media Materials by Validator 2

Parameters	Score (%)	Criteria
Module Content Accuracy	80	Valid
Module Guide and Answer Key	93	Valid
Language and Writing Module	80	Valid
Module Questions Construction	80	Valid
Average	80	Valid

Based on the results of the material expert assessment (validator 2) which can be seen in Table 4, it shows that the QR Code-based learning media has referred to the valid category with an average of 80%. The figures obtained indicate that this learning media can be used.

Media Expert Validation Phase I

Media expert validation was carried out with statements related to Module Cover Design, Illustration and Image Support, Module Content Layout, Module Content Typography, then media expert validators gave an assessment of QR Code-based learning media on their use in field practicum on invertebrate species in Invertebrate Zoology course. in the form of a module. The results of material expert validation by validators can be seen in Table 5.

Table 5. Validation Results of Learning Media Experts

Parameters	Score	Criteria
Module Cover Design	60	Quite Valid
Illustration and Image Support	80	Valid
Module Content Layout	50	Quite Valid
Module Content Typography	40	Not Valid
Average	58	Quite Valid

Based on the results of the media expert's assessment as shown in Table 5, it shows that the QR Code-based learning media already refers to the fairly valid category with an average of 58%. The figures obtained indicate that this learning media can be used with revisions.

Media Expert Validation Phase II

Media expert validation was carried out with statements related to Module Cover Design, Illustration and Image Support, Module Content Layout, Module Content Typography, then media expert validators gave an assessment of QR Code-based learning media on their use in field practicum on invertebrate species in Invertebrate Zoology course in the form of a module. The results of material expert validation by validators can be seen in Table 6.

Table 6. Learning Media Validation Results (after revision)

Parameters	Score (%)	Criteria
Module Cover Design	93	Very Valid
Illustration and Image Support	86	Very Valid
Module Content Layout	90	Very Valid
Module Content Typography	85	Very Valid
Average	88.5	Very Valid

Based on the results of the validator's assessment as shown in Table 6, it shows that the QR Code-based learning media has referred to the very valid category with an average of 88.5%. The numbers obtained show that this learning media can be used after changes or revisions are made according to the suggestions given by the validator.

Learning Media Revision Results

After the assessment, the revision of the learning media was carried out based on the suggestions and inputs given by the validator (Hadiyanti et al., 2021). Input and advice from experts, namely: the design of the cover of the writing module must be enlarged and the color of the cover changed; there is a barcode that cannot be scanned; and grammar, layout, and numbering. The revision of the QR Code-based learning media product is front page section and instructions for use.

Implementation

This stage is a continuation of the Development stage. At this stage, all media designs that have been developed are implemented after revision (Serevina et al., 2018; Sofyan et al., 2019). The QR Code-based learning media that has been developed is implemented in real situations, namely in the field. However, at this stage, the researcher only carried out product trials on small groups (limited test) by looking at the responses of students to the learning media that had been developed. The trial is intended to see the level of practicality of the media.

During the limited trial, the researcher/developer explained what was contained in the learning media. This is done by the developer so that students are more enthusiastic when studying the material on the learning media. After the students finished paying attention to the learning media, on the last day of the trial, a questionnaire was given by the developer. This questionnaire aims to see the extent to which student responses to QR Code-based learning media have been developed. The limited trial stage of QR Code-based learning media on Invertebrate species material for the Invertebrate Zoology course was applied to 4th semester students of biology education. The data on the results of student assessments of QR Code-based learning media can be seen in Table 6 and Table 7.

Practical Data Analysis Results

Practical data analysis was carried out by students in order to know that the QR Code-based learning media was practical to use (Sejati & Sayekti, 2023; Solihatin et al., 2020). The results of the practicality analysis can be seen in Table 7.

Based on the results of student assessments shown in Table 7, it shows that the QR Code-based learning media has referred to the practical category with an average of 80%. The numbers obtained show that this learning media can be used.

Table 7. Results of Practical Data Analysis of Learning Media

Parameters	Score (%)	Criteria
Module view aspect	80	Practical
Aspects of language eligibility	72	Practical
Aspects of module content	95	Very Practical
Aspects of how to use the module	73	Practical
Average	80	Practical

Student response data to QR Code-based learning media on invertebrate species in invertebrate zoology courses.

Data on student responses to QR Code-based learning media on invertebrate species in the

Invertebrate Zoology course were taken using a questionnaire technique.

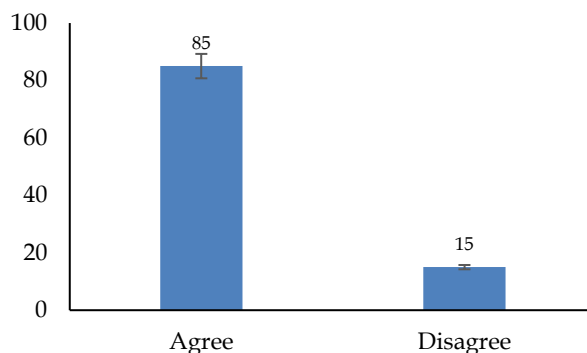


Figure 1. Data on student responses to QR Code-based learning media on invertebrate species in the Invertebrate Zoology course

The results of the student response analysis shown in table 4.6 show that the students responded agreeing with 85% of the answers "agree" to the statement items regarding QR Code-based learning media on invertebrate species in the Invertebrate Zoology course.

Evaluation

Evaluation is the final stage of the ADDIE development model (Abd Razak et al., 2020; Sahaat et al., 2020). Because in this study there were only limited trials, the evaluation referred to here is an evaluation of implementation activities. The evaluation results were obtained from student suggestions during the trial run, so that from this evaluation stage a final revision was carried out.

Discussion

This stage the researchers made observations on the learning process taking place with the subject lecturers. Observations were made on April 25, 2022. One of the aspects analyzed at this stage is Course Learning Outcomes. The analysis carried out in this study is to pay attention to the characteristics of the curriculum that is currently running on a campus. The development carried out can be in accordance with the learning outcomes of the subject. This analysis aims to examine the Subject Learning Outcomes, Sub-Course Learning Outcomes in achieving applicable learning in the Biology Education Study Program, Puangrimaggalatung University, namely mastering knowledge about invertebrate animals and their role for humans. Based on the results of observations made with 4th semester students of Biology Education Study Program, it was found that most students still had difficulties in field practicum in adjusting Invertebrate Zoology material including understanding,

classification, characteristics, reproduction, and the role of each invertebrate species found.

Another supporting reason is that in the 4th semester biology education study program, it is known that there is no QR Code-based module as a learning medium. So it is hoped that with the development of QR Code-based learning media on invertebrate species material in the form of modules that are made as good as possible so that they are suitable for use in the learning process and in the field practicum process.

Specification/formulation of learning objectives

After the analysis is done, then formulate the main discussion that will be achieved by students in the learning process. The main topics of discussion are raised from the materials to be taught, namely: definition of each invertebrate species; classification of each invertebrate species; characteristics of each invertebrate species; reproduction of each invertebrate species; and the role of each invertebrate species (Auliaty et al., 2021).

The developed media that has been compiled is a QR Code-based module in the invertebrate zoology course for biology education students (Ardika et al., 2022). The design of the components in the QR Code-based media in the form of modules, namely the cover, front page, instructions for use, the content of the material includes the understanding of each invertebrate species, the classification of each invertebrate species, the characteristics of each invertebrate species, the reproduction of each invertebrate species, the role of each invertebrate species. invertebrate species, and evaluation. Then the QR Code is a draft of the contents of the Invertebrate Zoology module in the form of an image of each invertebrate species that is used as a barcode created using a QR Code Generator in the form of a module. The main purpose of QR Codes is currently used to access information by scanning barcodes on each invertebrate species according to the opinion (Ataji, 2019; Lee et al., 2011), which states that using QR Codes and smartphones applied in the classroom can provide many advantages such as books. illustrated and easy-to-use guide suitable for student level.

The next step in development research after the planning stage of learning media is the validation stage. The validation stage was carried out by a material expert, namely Dr. Muhammad Nur, M.Pd and Dr. H. Muhammad Arafah., M.Pd while the development experts are Muhammad Nasir, S.Pd., M.Pd. implemented in April 2022. The assessment uses a questionnaire, which is a type of questionnaire that contains a rating scale. Assessment according to the components of the accuracy of the content of the module, the module manual and answer keys, the language and

writing of the module, the construction of module questions.

The results of the validation of QR Code-based learning media materials on invertebrate species have met the criteria for valid learning media, because the four components have valid criteria, namely the component accuracy of the module content, the manual and answer keys for the module and the language and writing of the module, the construction of module questions (Mustika et al., 2022). As for the validation of QR Code-based learning media on invertebrate species material including module cover design, illustrations and image support, module content layout, module content typography has met the criteria for valid learning media.

Product Revision Results

After the assessment, the revision of the learning media was carried out based on the suggestions and inputs given by the validator. The inputs and suggestions include changing the color module cover and increasing the font size, layout and language and numbering. The next step is to conduct a limited trial from April 25 to May 23, 2022 at the Puangrimaggalatung University campus to find out whether it is feasible to use QR Code-based learning media on Invertebrate species material.

Practical data on QR Code-based learning media on invertebrate species material for invertebrate zoology courses.

The data was taken using a questionnaire technique, based on the analysis, it was found that 80% of the learning media were based on QR Code on the material of invertebrate species in the invertebrate zoology course. Based on these data, it can be concluded that the QR Code-based learning media material for invertebrate species in the Invertebrate Zoology course is practically.

Data was taken using a questionnaire technique, based on a questionnaire technique, based on the analysis, it was found that students agreed with the development of QR Code-based learning media on invertebrate species in the Invertebrate Zoology course. Based on these data, it can be concluded that students' responses to QR Code-based learning media on invertebrate species in the Invertebrate Zoology course are very good.

Finally, the evaluation stage carried out in the form of evaluation of learning media products was carried out by 4th semester students of biology education study program to find out how the response to the developed media was. From the suggestions obtained from students during the trial, the learning media in the form of practical modules were used as learning media.

This is in line with Sani's statement (2014) which states that learning using modules is an independent learning process regarding a particular unit of discussion by using teaching materials that are arranged systematically, operationally, and directed for use by students, accompanied by guidelines for their use for teachers/lecturers so that based on the results of research and data analysis that has been carried out it can be concluded that "Development of a QR Code-based Invertebrate Species Module in its use in the field practicum for invertebrate zoology courses" is valid, practical, and feasible to be used as a support for learning in courses invertebrate zoology.

Conclusion

QR Code-based learning media on invertebrate species material for invertebrate zoology courses is suitable for use based on the assessment of material experts I by 88% and material experts II by 80% with valid categories, media experts by 88.5% so that QR Code-based learning media can be used well as a learning medium. Based on practicality data analysis, it was found that 80% of QR Code-based learning media on invertebrate species material in invertebrate zoology courses were practically used and 85% agreed responses from students.

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Conflicts of Interest

The authors declare no conflict of interest.

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