

Making an E-Pocket Book Based on the Isolation Study of Endophytic Bacteria of Laban Plants That Produce Secondary Metabolite Compounds as Enrichment Material for Natural Material Chemistry Courses

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Abstract. This research addresses the need for effective teaching materials in natural materials chemistry courses, specifically focusing on secondary metabolite compounds derived from endophytic bacteria of laban plants. The main objective is to develop a valid e-pocket book that serves as an enrichment resource for lecturers and students. This study used a research and development approach using the 4-D model, which includes the stages of defining, designing, developing, and disseminating. However, this research was limited to the development stage. The E-Pocket Book was assessed for validity through various aspects, including content feasibility, presentation, grammar, graphics, appearance, and software utilisation. Validation involved feedback from material and media validators, as well as responses from chemistry education lecturers and students. Results showed that the E-Pocket Book achieved a highly valid category with an overall average score of 98.785% across the six assessment aspects. Feedback from chemistry education lecturers showed excellent criteria, with scores of 87.50% for content appropriateness and for usefulness, and 91.67% for ease of use. Similarly, student feedback reflected high satisfaction, with scores of 86.67% for ease of use, 85% for benefits of use and 83.09% for attractiveness of presentation. In conclusion, the developed E-Pocket Book was validated as a practical and effective teaching material for secondary metabolite compounds, demonstrating its potential to enhance the learning experience in natural materials chemistry courses. This study highlights the importance of incorporating user feedback in the development process to ensure materials meet educational needs and preferences.

Keywords: E-pocket book, 4-D model, secondary metabolite compounds, validity

Introduction

The introduction Technological advances in the 21st century make teaching materials indispensable to attract students' attention in learning, both classroom learning and self-study to increase knowledge and literacy. Big attention to literacy skills is closely related to Indonesia's position, which has consistently ranked low in the Program for International Student Assessment (PISA) tests in the last twenty years. In 2012, Indonesia was rated 64th out of 65 nations with an average score of 375 (OECD 2014). Three years later, by

obtaining an average score of 403, Indonesia's position increased to 62 out of 70 countries in 2015 (OECD 2018). However, in the next PISA test, Indonesia's average score dropped to 371 in 2018 and was ranked 74th out of 79 competing countries (Avvisati et al, 2019). From this perspective, Indonesia's education is far behind the Southeast Asian countries participating in PISA. With an average literacy score of 393, Indonesia is 22 points behind Thailand (Avvisati et al, 2019). Indonesia's literacy rating is also lower than Malaysia's 415 (Avvisati, et al 2019). Indonesia is far behind Vietnam's literacy, with an average score of 505 (Avvisati et al, 2019). In 2019 Indonesia ranked 62 out of 70 countries, or the bottom 10 countries with low literacy levels. In 2022, Indonesia's ranking in PISA rose 5 positions compared to before for reading literacy (Darmajati, 2019). Based on this data, it can be seen that today's society or students are very minimal in literacy and interest in reading so that an innovative teaching material is needed that is able to attract students' interest in reading so that they can add insight into a phenomenon that is around them. One form of teaching material that can help to foster student interest in reading is a pocket book.

Students will be motivated in learning if there is an appropriate and interesting learning media available (Anggraeni & Aisyah, 2016). Pocketbook media can increase learning motivation, because it has a positive influence where students are interested in reading, easy to carry everywhere, an attractive appearance equipped with pictures and colors, thus fostering student motivation to study the material in the pocketbook (Nurhayati, 2019). Students who do not have motivation to learn will show an unenthusiastic attitude and do not want to know about the subject matter (Jami, 2020).

E-Pocket Book is a learning media for students that is packaged in the form of electronic media. E-Pocket Book is packed with a variety of short, concise and clear writing and contains interesting pictures so that it can be used in the learning process to help and facilitate students to read the material contained in the e-pocket book (Lestariningsih & Suardiman, 2017; Maulida et al., 2015; Muharram et al., 2010). E-Pocket Book is published in a small size using A6 paper (10.5 x 14.8 cm). With a relatively small pocket book size, making this pocket book practical and easy to carry anywhere so that it can help students to learn independently. E-Pocket Book is an electronic teaching material that has several advantages, namely 1) able to present a large amount of material, 2) material can be studied by students according to their interests and speed needs, 3) can be studied anytime and anywhere because it can be accessed online, 4) makes learning more effective because this teaching material is equipped with colourful images, and 5) repair or revision is easy to do (Susilana & Cepi, 2008).

Based on interviews conducted with lecturers teaching KBA courses in the Chemistry Education Study Program, it is known that the learning resources used are limited to books, power points originating from lecturers, and analysis of articles related to secondary metabolite compound material so that student learning outcomes are still relatively low, so it is necessary to be equipped with an enrichment book, namely an e-pocket book based on the isolation study of endophytic bacteria of laban plants. The source of secondary metabolite compounds studied in this new curriculum generally only comes from or is limited to plants.

It is known that most secondary metabolites have a lot of potential as raw materials for medicines, pesticides, and many more. One example of a compound that is useful as medicine is Phomopsichalasin which functions as an antibiotic. One example of a secondary metabolite compound that is useful as a pesticide is the Oocydin A compound and functions as an antifungal (Putrie, 2015). In general, secondary metabolite compounds in plants are usually found in small amounts. In addition, isolating these plants takes a relatively long time and requires a large number of plants to obtain secondary metabolite compounds in large quantities as well. An alternative that can be used to obtain many secondary metabolite compounds is to isolate endophytic bacteria in plants. Endophytic microbes have

the ability to produce secondary metabolite compounds that are almost similar to their host plants. Specific endophytic microbes obtained from the inside of the plant are expected to produce a number of bioactive compounds needed without having to extract them from the plant. The time required to isolate bacteria is relatively short so that endophytic bacteria can be relied upon to produce secondary metabolite compounds in large quantities. (Bac, et al., 2015; Li, et al., 2012; Singh, et al., 2013; Barry, 2014; Kai, et al., 2013).

There have been many studies that discuss endophytic bacteria used as agents that produce potential secondary metabolite compounds. One example is isolating endophytic bacteria from laban plants. Laban plant (*Vitex pubescens* Vahl) is one of the *Vitex* species that is commonly found in Sumatra and Kalimantan, Indonesia. Based on pharmacological studies, laban plants have benefits as a medicine for lumbago, wounds, appetite enhancers, dysentery, indigestion, anti-inflammatory, antitumour, rhinitis and fever. Based on phytochemistry, the stem bark of laban plants contains flavonoids, triterpenoids, phenolic and diterpenoid compounds, while the leaves of laban plants contain secondary metabolites such as alkaloids, flavonoids and terpenoids/steroids that contribute to their various bioactivities (Anwar et al., 2019). This plant is known to produce betulinic acid, 14-deoxyandrographolide, and andrographolide compounds that provide relatively strong cytotoxic activity against HL-60 leukaemia cells with % viability of 40.7, 49.8 and 43.6% at a concentration of 25 µg/mL, respectively (Anwar, 2018).

Due to the absence of information sources regarding the potential of endophytic bacteria as producers of secondary metabolite compounds, it is necessary to innovate teaching materials that can be used to add insight and knowledge related to secondary metabolite compounds. In addition, these teaching materials must have an attractive and practical design so that they can make learning more interesting. Therefore, researchers developed a pocket book which is the result of a literature study of several articles and also the results of endophytic bacterial isolation research that researchers conducted themselves. This pocket book was developed to increase students' literacy and knowledge that secondary metabolite compounds can be produced from microbes or bacteria.

This study aims to develop an e-pocket book based on the isolation study results of Laban plant endophytic bacteria producing secondary metabolite compounds that are valid, practical, and effective as enrichment materials for natural materials chemistry courses based on the assessment of material experts, media experts, and student responses and evaluate the effectiveness of using e-pocket books in improving student understanding of endophytic bacterial isolation material and secondary metabolites in natural materials chemistry courses. Therefore, it is hoped that this research can have a positive impact on the world of education as an alternative teaching material that is interesting and innovative and can be used as an independent learning resource for students, especially at the University of Riau.

Methods

This development model is designed using a research and development design based on research and development (R&D) using the 4-D model. The model used is the development of the 4-D model. The 4-D (Four D) development model is a learning device development model. This model was developed by Thiagarajan. The 4D development model consists of 4 main stages, namely: define, design, develop and disseminate (Abdias et al., 2019). The rationale for choosing the use of this 4D model is because each step of the development procedure stage is explained in detail, what researchers will do when developing products in the form of teaching materials, books, or other teaching materials. This method and model was chosen because it aims to produce a product in the form of an e-pocket book based on the isolation study of endophytic bacteria of laban plants producing

valid secondary metabolite compounds. The developed product is then tested for feasibility with validity and product trials to determine the extent of user response.

This research was carried out at the chemistry education study programme, faculty of teacher training and education (FKIP), Riau University Pekanbaru with research from october 2023 - march 2024. The subjects in the research conducted were three chemistry education students of class 2020 with different basic abilities to be tested in a one-on-one trial, 15 students who had studied secondary metabolite compound material to be tested in small groups using a user response questionnaire. As well as trials to one chemistry education lecturer at the University of Riau and one chemistry lecturer at the University of Riau to ask for user responses to the feasibility of the contents of the e-pocket book. The data obtained based on the validator's assessment of the e-pocket book of secondary metabolite compounds and the practicality of the e-Pocket book of secondary metabolite compounds from the responses of lecturers and students were then analysed using the following analysis.

Analysis of Validator Assessment Data

The validity analysis of this e-pocket book was conducted on the media and material aspects. The type of scale used is a Likert scale with a score of 1-4. This scale provides flexibility to the validator in assessing the learning device in the form of an e-pocket book that has been developed. Validation of media experts and material experts on the developed learning media is determined by the average score given by the validator. as in table 1. The selection of a four-choice likert scale aims to anticipate the selection of neutral points. Each score has certain assessment criteria, such as the rubric that will be attached.

Table 1. Likert scale for validation stage

Statement of attitude	Score
Strongly agree	4
Agree	3
Less agree	2
Disagree	1

(Widoyoko, 2012)

Percentage analysis eligibility criteria can be seen in Table 2

Table 2. Percentage analysis feasibility criteria

Analysis Feasibility (%)	Description
81 – 100	Very Good/ Highly Valid/ Highly Feasible
61 – 80	Good/ Valid/ Feasible
41 – 60	sufficient Good/ sufficient Valid/ sufficient Feasible
21 – 40	Less Good/ Less Valid/ Less Feasible
<20	Not good/ not valid/ not feasible

(Riduwan, 2018)

Analysis of User Assessment Data

a) Analysis of Lecture

The lecturer's response is arranged based on a likert scale consisting of an interval of "strongly agree" to "disagree" with four choices. The answer choices given by teachers and students will be converted with a score of 1 to 4, as in Table 3.

Table 3. Positive statement alternative scores

Statement of attitude	Skor
Strongly agree	4
Agree	3
Less agree	2
Disagree	1

Percentage analysis eligibility criteria can be seen in Table 4

Table 4. Criteria for lecturer response

Lecturer Response (%)	Description
80 – 100	very good
60 – 79	Good
40 – 59	Less good
0 – 39	Not good

(Yamasari, 2010)

b) Analysis of student

Analysis of student responses using student response questionnaires measured with a Likert scale in the form of a checklist (√). The answers to each instrument item in the form of alternative positive attitude statements that have been determined have a gradation from very positive to very negative (Widoyoko, 2012). The alternative positive attitude statements are converted into scores using a four Likert scale, as in Table 5

Table 5. Positive statement alternative score

Statement of attitude	Scor
Strongly agree	4
Agree	3
Less agree	2
Disagree	1
Strongly agree	4
Agree	3

Percentage analysis eligibility criteria can be seen in Table 6

Table 6. Criteria for student response

Student Response (%)	Descriptin
80 – 100	very good
60 – 79	Good
40 – 59	Less good
0 - 39	Not good

Results and Discussion

The product produced from this research is an e-pocket book based on the isolation study of laban plant endophytic bacteria as an enrichment material for natural material chemistry subjects using the research and development (R&D) development method with the 4-D development model. This 4-D development research was carried out only to develop e-pocket book and test the feasibility of e-pocket book which has been declared valid by material expert validators and media expert validators. Then one-on-one trials and student and lecturer response trials were conducted. The stages of this e-pocket book development are discussed in detail as follows.

Define Stage

The defining stage leads the researcher to do some determination of the requirements for the preparation of the e-pocket book, including front end analysis, student analysis, and material analysis.

a) Front end analysis

The results of the front end analysis are that there are still limited teaching materials that can facilitate students in finding and understanding the concept of secondary metabolite compound material and the use of teaching materials used is still limited in terms of technology use. The problem that can be found is that there are still limited teaching materials that can facilitate students in finding and understanding the concept of secondary metabolite compound material and the use of teaching materials that are still limited in terms of using technology. Educators only use books and power points and analyse articles related to secondary metabolite compound material so that the availability of teaching materials is still not maximised. The sources of secondary metabolite compounds studied in this new curriculum generally only come from or are limited to plants so that additional references are needed that contain information that endophytic bacteria are also able to produce secondary metabolite compounds that are almost similar to their host plants in a relatively short time. According to Heryani & Rustina (2018) printed teaching materials have several shortcomings, namely less informative because they are unable to present movement, presentation of material is linear, and less flexible because it is not easy to carry and use at any time. The use of technology as a learning medium is also not optimal. The utilisation of technology should be improved, because technology will continue to develop so that lecturers and students must keep up with these technological developments so as not to be left behind with the times. Therefore, it is necessary to have teaching materials in the form of E-Pocket Book in order to broaden students' knowledge related to endophytic bacteria that are able to produce secondary metabolite compounds that are almost similar to their host plants and maximise the use of technology in the learning process. The use of technology in the learning process can be done by utilising software to create E-Pocket books or teaching materials. One software that can be used is

Heyzine Flipbook. According to (Humairah, 2022) Heyzine Flipbook is an interactive media maker website that allows users to add various types of interactive media to the flipbook so as to make the media more interesting. Heyzine Flipbook software has been widely used in making interactive learning media in the classroom. This is because the manufacturing process is easy but can create innovative and interesting work. Heyzine flipbook can be used as a medium in making e-pocket book.

b) Student analysis

Student analysis is needed in making E-Pocket Book products because the learning process must be adjusted to the stages of student cognitive development. Chemistry education students class of 2020 have an age range of 20-22 years. Piaget as an expert in cognitive development said that early adulthood, in this case students, are at the formal operational stage. The formal operational stage is the last stage in cognitive development according to Piaget. At this stage of age 12 years and over, a child is able to think logically, and begins to be able to accept assumptions without requiring physical evidence to validate these assumptions, and is able to develop hypotheses, and test them, and can evaluate the results and restate the hypothesis if the results are not in accordance with previous assumptions and children in this stage also have the ability to consider various possible solutions to a problem before the child acts, but due to lack of experience, it limits their knowledge and ability to take advantage of what is known (Salkind, 2010). The results of the student analysis obtained show that students have a low interest in reading or literacy, but the level of curiosity and interest in learning is high if supported by innovative and interactive teaching materials. Students who are used as respondents in their daily lives tend not to be able to be separated from gadgets, laptops, or PCs. Therefore, students need teaching materials such as E-Pocket Book that can attract student interest and focus in learning the material because it is combined with the use of technology in the learning process.

c) Material analysis

Material analysis is an analysis of the content of the material based on the material developed, namely secondary metabolite compounds. The developed E-Pocket Book is a type of enrichment book. Enrichment books are books that contain material that can enrich and broaden students' insights in the fields of knowledge, skills, and personality and are complementary to the main textbook. (Sitepu, 2015). Enrichment books are not fully compiled based on the framework or CPMK that has been set in the curriculum. This book is a support, not as a main guideline in learning. The E-Pocket Book that has been prepared is related to Sub CPMK 1 in the RPS Chemistry of Natural Materials Chemistry Education FKIP Riau University. The results of the analysis can be seen in the following table.

Table 7. Material analysis results

End Capability of Each Learning Stage (Sub-CPMK)	Indicators	learning material
(Sub-CPMK 1)	1.1 Accuracy in explaining the difference between primary and secondary metabolites	- Differences between primary metabolites and secondary metabolites, classification and identification of secondary metabolites
Able to summarise and analyse the differences between primary metabolites and secondary metabolites, classification and identification of secondary metabolite compounds in natural materials with independent, quality, measurable and responsible performance.	1.2 Accuracy in identifying secondary metabolites from their structure and reaction to reagents	

Design stage

The design stage produced an initial draft of the E-Pocket Book, validation sheet instrument, and user response questionnaire. The designed e-pocket book resulted in the initial draft of the e-pocket book. According to Sankarto & Endang (2008), pocket books have several characteristics, namely 1) the number of pages is not limited, at least 24 pages, 2) Compiled following the rules of popular scientific writing, 3) Presentation of information in accordance with the interests, 4) The referred literature is not included in the text, but listed at the end of the writing, 5) The author's name is included.

The design of assessment instruments is carried out at the design stage, where there are two types of assessment instruments, namely material and media validation sheets and user response questionnaires (lecturers and students). The material and media validation sheets refer to the Department of National Education (Depdiknas) in 2008. The material validation sheet has 4 aspects of eligibility, namely content eligibility, language eligibility, presentation, and graphics. Meanwhile, the media validation sheet according to the Directorate of High School Development (2010) contains 2 aspects, namely display aspects and software utilisation.

The design of the user response questionnaire sheet for lecturers and students aims to obtain information about the e-pocket book that has been developed. The response questionnaire of lecturers and students was designed by collecting relevant literature in accordance with the research needs by referring to the user response questionnaire (lecturers and students) from relevant research, so that the user response questionnaire design was obtained.

Development Stage

The result of the development stage is a valid e-pocket book based on the Isolation Study of Laban Plant Endophytic Bacteria Producing Sekuder Metabolite Compounds.

a) Product Validation

Product validation consists of material validation and media validation. Material validation consists of 4 aspects of assessment, namely aspects of content feasibility, language feasibility aspects, presentation feasibility aspects, and graphic aspects, while media validation consists of 2 aspects of assessment, namely display aspects and software utilization aspects. Material validation on the e-pocket book was carried out by 2 validators, namely Chemistry lecturers from Riau University and Biology Education lecturers from Riau University. While media validation on the e-pocket book was carried out by 1 validator, namely a lecturer in informatics engineering from the State Islamic University of Sultan Syarif Kasim Riau. Validation of the e-pocket book was carried out twice by validators, until the e-pocket book developed was declared valid or suitable for use.

Table 8. Validation Results of Pocket Book

Assessment Aspect	Score by Validators (%)	
	1 st Validation	2 nd Validation
Content Appropriateness	83.333	100
Language Feasibility	68.750	95.833
Presentation	91.667	100
Graphics	71.875	96.875
Display(Visual Communication)	87.500	100
Software Utilisation	90.000	100
Average Percentage	76.135	98.785
Validity Criteria	Valid	Highly valid

b) Product revision

The developed e-Pocket book cannot be tested because there are still some suggestions and comments from the validators.

Table 9. Saran dan Komentar dari Validator

No	Comments and Suggestions	Improvements Taken
Validator Materi		
1	Adding pictures to the section on the types of endophytic bacterial genus	Already added
2	Adding a working scheme of endophytic bacterial isolation	Already added
3	Image representation for easy understanding	Already fixed
4	Adding information to the phytochemical test results section	Already added
5	Improve the cover of the e-pocket book in accordance with the contents of the e-pocket book	Already fixed
6	Simplifying sentences so that they are easy to understand	Sentences have been simplified
Media Validator		
7	Add the author's identity on the cover page	Identity has been added on the cover page
8	Add back and continue buttons	Added buttons back and next buttons
9	Add a home button	Already added
10	Add instructions for using the pocket book	Already added
11	Try to make the table of contents clickable	Already fixed

c) Limited Trial

1) One-on-one trial

The one-on-one trial was conducted on three chemistry education students from the Class of 2020, the student identities can be seen in Appendix 13 page 157. The one-on-one trial aims to improve product use procedures, identify and eliminate errors in product use, and obtain information about user reactions to materials and messages that product users want to convey (Rusdi, 2019). In the one-on-one trial, each student is expected to observe the presentation of the e-pocket book of secondary metabolite compounds from endophytic bacteria, then access the e-pocket book, read the material in the e-pocket book, observe the video and at the final stage an interview is conducted to obtain a response to the e-pocket book developed. In this test, students gave opinions that this e-pocket book could be a learning tool for students because it already

contained complete material and had added videos. Students also suggested that the video barcode be replaced with a link to facilitate access to open the research video because not all mobile phones can scan the barcode.

Table 10. Student Comments on One-on-One Trial

Student code	Comments
MS-01	The appearance and colours of the e-pocket book are good. E-pocket book is complete and can be a means of independent learning for students
MS-02	Pay more attention to the space between sentences so that they are not too close together The appearance of the e-pocket book is interesting The e-pocket book as a whole is good The language used in the e-pocket book is easy to understand
MS-03	The appearance of the e-pocket book is good The writing can be tidied up again so that it is not too tight and the spaces can be tidied up again. The video barcode should be replaced with a link to facilitate access to open research videos because not all mobile phones can scan the barcode

2) Lecturer Response Test

The lecturer response test was carried out with the aim of knowing the suitability of the e-pocket book with the learning that was carried out. The lecturer gave a response according to the questionnaire which contained aspects of content feasibility, practicality aspects and also display aspects which were poured into 15 statements with 4 aspects consisting of 11 indicators. The results of the lecturer's response are listed in Table 9.

Table 9. Result of Lecture Response

Assessment Aspect	Average Per Indicator (%)
Content Appropriateness	87.500
Ease of Use	91.667
Benefits of Usage	87.500
Attractiveness of Presentation	85.416
Average Percentage	88.021
response criteria	Very Good

The lecturer's response was used as a reference to make revisions to the developed e-pocket book. Lecturer responses and revisions made are presented in Table 10.

Tabel 10. Lecturer response and revision

Lecture Code	Lecturer response	Revision
DS-01	E-Pocket Book of natural material chemistry is good for additional reference materials for KBA lectures.	- The table of contents needs to be reorganized and typos in the book need to be considered again
DS-02	The E-Pocket Book of natural material chemistry is good and can be used by students as a reference for self-study.	- Improvements to the presentation of images in the pocket book - Add chemical reactions to phytochemical testing

Student Response Test

Implementation of student response test carried out with a total of 15 participants who came from Students of the Class of 2020 Chemistry Education, University of Riau. listed in Appendix 16 page 163. Student response to e-pocket book was obtained using a questionnaire that contained 11 statements with 3 aspects consisting of 8 indicators. aspects consisting of 8 indicators. Based on the data obtained from the questionnaire questionnaire data, it can be seen that the average score of The average score of student responses to the indicators as a whole is 84.82%.

Table 10. Results Student Response

Assessment Aspect	Average Per Indicator(%)
Ease of Use	86.67
Benefits of Usage	85.00
Attractiveness of Presentation	83.09
Average Percentage	84.82
response criteria	Very Good

The small group trial was conducted on 15 students on the e-pocket book which contained 11 statements with 3 aspects consisting of 8 indicators. Based on data processing from student response questionnaires, the average student response score to all aspects is 84.82%. Referring to the validation criteria in table 6 with a percentage score > 80% with very good criteria.

The validation of the content feasibility aspect has 6 assessment components that aim to assess the quality of the E-LKPD content. The results of validation I in the aspect of content feasibility were 83.333% with very valid criteria, but there were still suggestions from the validator so that improvements needed to be made. The validator gave 2 inputs, namely the first input to add a working scheme of endophytic bacterial isolation research so that students know the stages of work on how to isolate endophytic bacteria from laban plants. This is in line with what was stated by Hanief, (2020). The purpose of the research scheme is to describe a stage of problem solving in a simple, decomposed and neat manner so that it can add insight to students related to this material. The second input Validator suggested adding pictures to the types of endophytic bacterial genus so that students know more about how the types of endophytic bacterial genus look like. This is in accordance with what Amir (2016) stated that the use of appropriate images and colours in the pocket book design will increase interest in reading it. Colour can also be a form of non-verbal communication that can convey messages instantly and more meaningfully. After making

improvements according to the input and suggestions of the validator, the Validation II score on the aspect of content eligibility was 100% with very valid criteria.

The validation of the presentation aspect has 3 assessment components which aim to assess the quality of presentation in the E-Pocket Book, both the format of the E-Pocket Book and the systematics of the E-Pocket Book. The results of the first validation on the presentation aspect were 91.667% with very valid criteria, but there were still suggestions from the validator so that improvements needed to be made. Validation II shows an average percentage score of 100% with very valid criteria. In the presentation aspect, the validator suggested adding information to the phytochemical test results so that students better understand what is meant by the phytochemical test results. This is in line with the opinion of Kristanti, et al (2008) that phytochemical screening is a preliminary stage in a phytochemical study which aims to provide an overview of the class of compounds contained in the plant under study. The phytochemical screening method is carried out by looking at the colour testing reaction using a colour reagent. The results of validation II on the E-Pocket Book based on the Isolation Study of Laban Plant Endophytic Bacteria Producing Secondary Metabolite Compounds in the presentation aspect are 100% with very valid criteria. Overall, the quality of the presentation of the E-Pocket Book based on the Isolation Study of Laban Plant Endophytic Bacteria Producing Secondary Metabolite Compounds has a complete E-Pocket Book format and is in accordance with the material.

The validation of language aspects has 6 assessment components that aim to assess the level of readability or language use in E-LKPD. The results of the first validation in the language aspect were 68.750% with fairly valid criteria, so improvements need to be made to improve the E-Pocket Book. The validator provided 2 inputs, namely the validator assessed that there were several writing errors (typos) so that improvements needed to be made according to the suggestions and input from the validator. This is done to make it easier for students to understand the contents in the E-Pocket Book. In addition, the validator assessed that there were several punctuation errors so that improvements needed to be made according to the suggestions and input from the validator. This is done to make it easier for students to understand the meaning in the E-Pocket Book. The second input of the validator assessed the improvement of the language used in the E-Pocket Book based on the Isolation Study of Endophytic Bacteria of Laban Plants Producing Secondary Metabolite Compounds to correct writing errors, punctuation, and the use of more communicative words to make it easier for students to understand. A valid E-Pocket Book must have language that is in accordance with good Indonesian language rules, easy to understand, and has a clear sentence structure. This is in line with what Fitria (2013) stated that the language aspect must use spelling that is easy to understand. According to Prastowo (2016) in Budiono (2014) states that language standards in the E-Pocket Book which include the use of good and correct Indonesian can affect student activity and response to the E-Pocket Book. The results of validation II of the E-Pocket Book based on the isolation study of endophytic bacteria of laban plants producing secondary metabolite compounds in the language aspect were 95.833% with very valid criteria.

The validation of the graphical aspect has 4 assessment components that aim to assess the accuracy of the layout, writing, images/photos, and design of the E-Pocket Book. The results of the first validation on the presentation aspect were 71.875% with valid criteria, but there were still suggestions from the validator so that improvements needed to be made. The validator provided 2 inputs, namely the first input, the validator suggested improving the image on the cover of the e-pocket book to match the content or content in the e-pocket book. The second input, the validator suggested to improve the presentation of images on the e-pocket book. This has been improved according to the suggestions and input from the validator for the E-Pocket Book improvement process. A valid E-Pocket Book must have an attractive cover design and E-Pocket Book content design in order to increase student reading interest. This is in line with the opinion expressed by Mudjito (2001) that

a reading book with an attractive cover and equipped with pictures can arouse someone's interest in reading it. The results of validation II on the graphic aspect are 96.875% with very valid criteria. Overall, the E-Pocket Book based on the isolation study of laban plant endophytic bacteria producing secondary metabolite compounds has illustrations or images related to the concept of good material, attractive layout, and has an attractive appearance design. This shows that the e-pocket book design developed is good and attractive including the type and size of the font used, layout, and layout that attracts students' attention to use it (Astra et al., 2020).

The following is a diagram of the validation results from the aspects of content feasibility, grammatical feasibility, presentation feasibility and graphics by material validators.

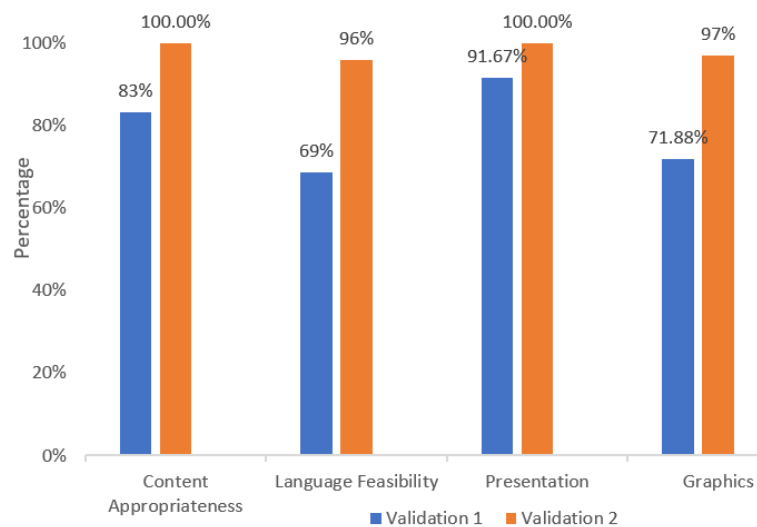


Figure 1. Diagram of material validation

The validation of the display aspect has 8 assessment components that aim to assess the quality of electronic media used in the presentation of the E-Pocket Book, both the format of the E-Pocket Book and the systematics of the E-Pocket Book. The results of the first validation on the display aspect were 87.5% with very valid criteria, but there were still suggestions from the validator so that improvements needed to be made. The validator gave 2 inputs, namely the first input, the validator suggested adding a back and next button, a home button, and instructions for using the e-pocket book. The purpose of the improvement is to make it easier to use the E-Pocket Book and the function of the e-pocket book usage instructions to make it easier for readers to use the symbols in the e-pocket book application. The second input from the validator suggested adding an identity to the cover page of the e-pocket book. The purpose of the improvement is to show the originality and author of the e-pocket book made. After making improvements, the results of validation II were obtained at 100% with very valid criteria.

Validation of the software utilisation aspect consists of 5 assessment components to assess the effectiveness of the software used in making e- pocket book. The first validation results on the display aspect were 90% with very valid criteria, but there were still suggestions from the validator so that improvements needed to be made. The validator suggested that the e-pocket book response section to users could take less than a second and the validator also suggested that the table of contents could be clicked to make it easier for users to go directly to the desired page. After making improvements, the validation II results were obtained at 100% with very valid criteria.

The following is a diagram of the validation results from the display aspect and the software utilisation aspect by media validators.



Figure 2. Diagram of media validation

The development product is said to be practical if the product is easy for lecturers and students to run. The practicality test is focused on data about the ability of students to confirm the success of improving product results before the field test. This is confirmed by Ibrahim & Subali (2017) that the practicality of the development product can be obtained by observing whether the user of the book has difficulty in using the product. To find out this practicality, one-on-one trials and user response tests were conducted.

Response tests with chemistry education lecturers and chemistry lecturers FMIPA UNRI were carried out directly using a laptop or smartphone. Overall, the lecturer's response obtained an average score of 90.625% with aspects of content feasibility of 83.333%, aspects of ease of use of 91.667%, aspects of the benefits of use of 91.667% and aspects of the attractiveness of the presentation of 95.833% then the average total score is included in the criteria very good. In the aspect of content feasibility, it obtained a percentage of 83.333%, consisting of the lowest indicator, namely the suitability of the material with the RPS of Natural Material Chemistry in the E-Pocket Book by 75% and the pocketbook indicator according to the learning media needs of students on secondary metabolite compounds material by 75%. This is because the e-pocket book developed is a type of enrichment book. Enrichment books are complementary or supporting books that contain broader material and focus on a topic as a means to enrich students' understanding, insight and knowledge. This is in line with Oktaviane et al. (2020) that enrichment books are complementary or supporting books that focus on a particular topic to add insight into knowledge and enrichment books are not compiled entirely based on the curriculum or are not bound by the established curriculum. The material in the e-pocket book is only related to sub CPMK 1 in the RPS Chemistry of Natural Materials Chemistry Education FKIP Riau University.

In the aspect of ease of use, there is an indicator of the practicality of the e-pocket book obtained a percentage of 87.5%. This shows that overall the E-Pocket Book can be used as a student self-study facility, but because the e-pocket book developed is an enrichment book, it causes limited material discussed in the e-pocket, which only covers sub CPMK 1 and does not cover all sub CPMKs in secondary metabolite compound material.

In the aspect of the benefits of use, there is an indicator of increasing lieteration, obtained a percentage of 75%, where the lecturer assesses that the images presented in the e-pocket book are enough to arouse students' curiosity to study secondary metabolite compounds. In the aspect of attractiveness of presentation, there is an indicator of attractiveness, which obtained a score of 75%. This shows that the overall appearance and presentation of the E-Pocket Book is interesting enough to attract students' reading

interest. Small group trials were conducted with 15 participants of chemistry education students class of 2020. Small group trials are conducted face-to-face. Before giving the E-Pocket Book application to students, researchers first conveyed the aims and objectives of researchers to students. The researcher also gave a brief explanation of the E-Pocket Book of secondary metabolite compounds using the heyzine flipbook application. Then, researchers distributed E-Pocket Book applications and user response questionnaires to students.

The results of the small group trial to students received positive comments and suggestions from students. The average percentage of learner responses was 84.82% with aspects of ease of use of 86.67%, aspects of the benefits of use of 85%, and aspects of the attractiveness of the presentation of 83.09%. In the aspect of ease of use of E-Pocket Book as teaching material obtained the highest percentage of 86.67%. This shows that the E-Pocket Book can be operated easily by students and makes students enthusiastic in using it because it has an easy programme operation.

The aspect of the benefits of use gets an average percentage of 85% which has an indicator that increases knowledge. This shows that the contents of the E-Pocket Book secondary metabolite compounds are clear to understand. E-Pocket Book secondary metabolite compounds can add insight to students related to the material of metabolite compounds produced by endophytic bacteria. The video of the endophytic bacterial isolation process makes it easier for students to see the implementation of how the stages of the production of secondary metabolite compounds from endophytic bacteria. This is in line with what Fitriasari and Yuliani (2021) said that the images and videos in the E-Pocket Book help students visualise the material and can convey the message or content of the e-pocket book material so that students will easily process information well

The attractiveness of the presentation is a communicative indicator which gets a percentage of 78.33%. This is because the use of E-Pocket Book using heyzine flipbook is a new thing for students and also on and also not all smartphones on respondents can access the video link in the e-pocket book so that researchers make improvements and replace the link to a live video so that respondents can see the video presented directly.

Conclusion

E-pocket The e-pocket book of secondary metabolite compounds from endophytic bacteria is very valid according to the feasibility aspects of content, presentation, grammar, graphics, appearance, and software. The results of product validation by material and media validators obtained results in a very valid category. The very valid category consists of 6 aspects of assessment, namely aspects of content feasibility, presentation, grammar, graphics, appearance, and software with a percentage of assessment scores of 100%, 100%, 95.833%, 96.875%, 100%, and 100% respectively. So that the average score obtained from the 6 aspects is 98.785% with a very valid category. The response of chemistry education lecturers as users of E-pocket book secondary metabolite compounds from endophytic bacteria in the aspects of content feasibility, ease of use, benefits of use, and attractiveness of presentation with a percentage of assessment scores respectively 83.333%, 91.667%, 91.667%, and 95.833% with very good criteria. The response of 15 students to the E-pocket book of secondary metabolite compounds from endophytic bacteria based on aspects of ease of use, benefits of use, and attractiveness of presentation with a percentage of assessment scores respectively 86.67%, 85%, and 83.09% with very good criteria.

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