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# Development of Teaching Material of Tissue Culture Media and Protoplast Culture Based on Scientific Literacy

**Fauziyah Harahap[1*], Candra Gunawan Sihombing[2**]**

*[1]Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Jalan Willem Iskandar Pasar V Medan Estate 20221, North Sumatera, Indonesia*
*[2]Undergraduate Student of Biology Department, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Indonesia*
**fauziyahharahap@unimed.ac.id*
***chandrasihombing89044@gmail.com*

## *Abstract*

This study aims to find out the feasibility of tissue culture books based on scientific literacy on the topic of tissue culture media and protoplast culture. The subjects in this study were lecturers of tissue culture courses and students majoring in Biology at Universitas Negeri Medan. This research is a study using the Dick and Carrey model which reaches the eighth step, namely formative evaluation where the process or program is considered complete. The results showed that (1) the assessment of material experts based on content, the suitability of the material with basic competencies and scientific literacy components obtained an average score 3,69 or 92,3% with very worthy criteria, (2) teachers of learning design experts based on material, systematic delivery of material, the efficiency of tissue culture and linguistic books obtained an average score 3,26 or 81,5% with worthy criteria, (3) an assessment by an expert lecturer on book layout design based on the cover design and book content design obtained an average score 3,77 or 94,2% with very worthy criteria, (4) the assessment by the lecturer in the tissue culture course obtained an average score 3,80 or 94,8% with very worthy criteria and (5) the assessment by students obtained an average score 3,52 or 90,6% included the very worthy criteria. So it can be said that the tissue culture textbook based on science literacy that has been developed is feasible according to material expert lecturers, learning designs, book layout designs, lecturers in tissue culture courses and students so that tissue culture books based on scientific literacy on the topic of tissue culture media and protoplast culture can used as a main/additional book for lecturers, students, readers in general and researchers who are interested in the field of tissue culture.

***Keywords:*** *Development, textbook, scientific literacy, tissue culture media, protoplast culture*

## Abstrak

Penelitian ini bertujuan untuk mengetahui kelayakan buku ajar kultur jaringan berbasis literasi sains pada topik media kultur jaringan dan kultur protoplas. Subjek dalam penelitian ini adalah dosen mata kuliah kultur jaringan dan mahasiswa jurusan Biologi di Universitas Negeri Medan. Penelitian ini merupakan penelitian pengembangan dengan model Dick and Carrey yang dimodifikasi sampai pada langkah yang kedelapan yaitu evaluasi formatif dimana rancangan, proses, atau program sudah dianggap selesai. Hasil penelitian menunjukkan bahwa (1) penilaian dosen ahli materi berdasarkan kelayakan isi, kesesuaian materi dengan kompetensi dasar dan komponen literasi sains diperoleh skor rata-rata sebesar 3,69 atau 92,3% dengan kriteria sangat layak, (2) penilaian dosen ahli desain pembelajaran berdasarkan kesesuaian materi, sistematika penyampaian materi, efisiensi buku kultur jaringan dan kebahasaan diperoleh skor rata-rata sebesar 3,26 atau 81.5% dengan kriteria layak, (3) penilaian oleh dosen ahli desain *layout* buku berdasarkan desain sampul dan desain isi buku diperoleh skor rata-rata sebesar 3,77 atau 94,2% dengan kriteria sangat layak, (4) penilaian oleh dosen pengampu matakuliah kultur jaringan diperoleh skor rata-rata sebesar 3,80 atau 94,8% dengan kriteria sangat layak dan (5) penilaian oleh mahasiswa dengan rata rata 3,52 atau 90,6% yang termasuk kriteria sangat layak. Sehingga dapat disimpulkan bahwa buku kultur jaringan berbasis literasi sains yang dikembangkan telah layak menurut dosen ahli materi, desain pembelajaran, desain *layout* buku, dosen pengampu matakuliah kultur jaringan dan mahasiswa sehingga buku kultur jaringan berbasis literasi sains pada topik media kultur jaringan dan kultur protoplas dapat digunakan sebagai buku pendamping/tambahan bagi dosen, mahasiswa, pembaca secara umum dan peneliti yang tertarik di bidang kultur jaringan.

**Kata-kata kunci:** Pengembangan; buku ajar; literasi sains; media kultur jaringan; kultur protoplas

## Introduction

Learning activities are complex activities because they involve many components, one of which is the activity of producing a product. One of the components needed is material. Materials needed in learning activities are teaching materials. The role of media or learning materials is very important in the learning process. Learning is a process of transferring information, making the teacher as a facilitator not a learning resource for students. Without learning materials, learning will not produce anything. Thus, learning becomes more effective through experiments or demonstrations, and makes students more active in developing their intellectual potential directly (Supardi *et al*, 2017).

One of the competencies that a teacher needs to have in carrying out his duties is developing teaching materials. The development of teaching materials is used as a way to identify, develop, and evaluate learning content and strategies. In addition, the development of teaching materials considers the nature of the teaching material, the number of students, and the availability of the material. The development of teaching materials uses a flexible principle. The principle of flexibility means being able to accept new things that have not been included in the subject content. The principle of flexibility is that students are able to accept new things in subject content that have not been included in the teaching materials delivered by the teacher. One of the teaching materials that is easiest to make by teachers is teaching materials in printed form, namely textbooks. In the process of developing textbooks, teachers are also not allowed to make any. Everything must be made systematically. The content of textbooks must also attract students or readers. The purpose of developing teaching materials is to assist students in obtaining alternative teaching materials. In addition, it also makes learning activities more interesting. Development of teaching materials in terms of material, content, and language needs to be done so that it is suitable for use especially to respond to the industrial revolution 4.0. Development-oriented research product development, in the form of syllabus, contract lectures, lesson plans, practical guide, evaluation and assessment tool authentic that leads to ability higher order thinking (Hasruddin et al, 2016).

Textbooks are part of teaching materials designed so that students master 2 the competencies to be achieved. In the Regulation of the Minister of National Education of the Republic of Indonesia Number 11 of 2005 article 2 (two) types of textbooks as follows: (1) textbooks that are used as mandatory references by teachers and students in the learning process; and (2) enrichment books and reference books that serve to increase the knowledge

and insight of students. Based on the analysis of reference books, there are 10 chapters with introductory topics on tissue culture, tissue culture laboratories, tissue culture media, hormone concepts, in vitro plant breeding, soma clonal diversity, production of secondary metabolites, and preservation of germplasm in in vitro culture, plant acclimatization in vitro culture, and mango plant tissue culture. Tissue culture laboratory has indeed been discussed in this book, while for the implementation stage of tissue culture there is no topic yet. Meanwhile, one of the topics that need to be known in tissue culture is what processes must be passed in making a tissue culture product. Some Biology students have difficulty finding supporting books in learning plant tissue culture because of the limited books available in the library. This causes constraints on learning resources in the form of learning support books. So that it makes it difficult for students to understand and apply tissue culture learning in a study or mini-research.

Zulpadly et al. (2016) also revealed that in their research many students did not complete each indicator of the biotechnology material taught. As many as 63.44% of the students experienced high difficulty in sequencing the steps in tissue culture and identifying the process and advantages of doing tissue culture. In this material, it is known that many students do not understand the process and steps in carrying out tissue culture, students also do not understand the advantages and disadvantages of tissue culture. The lecture process in the Tissue Culture course at Medan State University also uses learning resources in the form of textbooks and teaching materials from journals. Some of the books and journals used are books compiled by subject lecturers.

Firman (2007) said that the reason why students' literacy levels in Indonesia is based on PISA is that most books emphasize the content dimension rather than the process and context dimensions. The results of the 2018 Program for International Student Assessment (PISA) survey announced the literacy results of 3 each country. In the category of reading, science and math skills, Indonesia's score is low because it is in the 74th position out of 79 countries. The low literacy skills of students in Indonesia are also influenced by the selection of teaching materials used in universities. Teaching materials play an important role in the learning process, namely as a medium for delivering information. Therefore, good teaching materials are needed so that learning objectives are achieved optimally. Good teaching materials are teaching materials that contain a balanced component of scientific literacy. The science literacy category is close to a balanced proportion, namely 42% for the science knowledge category, 19% for the science inquiry category, 19% for the science category as a

way of thinking, and 20% for the interaction between science and technology and the community (Wilkinson, 1999).

According to Kurniawati & Rahayu (2014) in studying plant tissue structure material, especially tissue culture students often experience difficulties. This difficulty can be caused by the absence of learning media other than textbooks which are used as the only learning medium and no other supporting media used in learning other than textbooks on plant tissue structure material. In addition, the availability of microscopes is also limited so that not all of them can observe various kinds of plant tissues at the time of study.

Based on the results of the student needs analysis that has been carried out through distributing questionnaires to students of the Department of Biology at the Universitas Negeri Medan, it was found that 85% of students stated that they really need scientific literacy-based textbooks in tissue culture courses. As many as 65% of students experienced difficulties in studying tissue culture laboratory materials and felt the need to add material for the steps in carrying out plant tissue culture. The difficulties experienced by students are in understanding the material, newly learned words, understanding pictures and analysing data. Based on the results of the student needs analysis above, a scientific literacy-based network culture textbook was developed. Understanding the fundamental aspects of scientific literacy will help students to understand the universe of science as a whole. In other words, students' scientific literacy skills can be improved, one of which is by developing textbook based on scientific literacy.

The book that has been the main book used by students is the book on tissue culture written by Fauziyah Harahap. The use of this book is adequate for several learning topics. However, according to Harahap (2010: 162) that in its implementation, many materials in this course are new for students, seem difficult, monotonous, and abstract for students. This is evident from the results of student examinations for the topic "tissue culture media, some media composition, organ culture (roots, meristems, shoots), haploid plant production (anther culture, pollen, ovule)" only got an average score of 6.4 (from the score range 1-10). Based on this background, most of the teaching materials circulating and used in universities are still small and do not yet contain a balanced scientific literacy component.

Therefore, the researcher intends to make a study entitled "Development of Tissue Culture Textbook Based on Scientific Literacy on Tissue Culture Protoplast Culture" which has a balanced, easy to understand, feasible and effective scientific literacy composition for students to use and reproduce books to support the learning process.

## Method

This research was conducted at the Department of Biology, Universitas Negeri Medan at Jl. William Iskandar Pasar V Medan Estate, Medan, North Sumatra, 20221 from April until September 2021. Type of research is a developing research (R&D). Research and development is a systematic study of knowledge complete scientific knowledge or understanding of the subject under study (Putra, 2012). The aim is to develop a textbook for students. This research is a development research using the Dick and Carrey model which is modified to the eighth step, namely formative evaluation where the design, process, or program is considered complete. The data collection technique used is a non-test technique, namely the use of questionnaires, observation and documentation.

Tissue culture textbooks that have been developed following the modified Dick and Carrey model will be validated to several relevant expert validators, namely: (1) Material Expert Validator: Agrotechnolgy Lecturer at Universitas Medan Area, (2) Learning Design Expert Validator: Biology Lecturer at UNIMED who teaching Research Methods, (3) Layout Expert Validator: Visual Arts Education Lecturer in UNIMED who teaches Illustration Drawing courses, (4) Validation of Respondent Lecturer who teaches tissue culture courses at UNIMED, and (5) assessment by students in the Department of Biology UNIMED.

The instrument used in the validation of this book is a questionnaire in the form of a rating scale that has weights with several indicators. The questionnaire used is included in the type of closed questionnaire containing a statement with the answer in a column, so that respondents just choose from one level by giving a check mark (Arikunto, 2010). The validation sheet data for validation of material expert, design expert, layout expert, lecturer responses, and student responses is in the form of a Likert scale that can be seen in Table 1.

Table 1. Criteria Answer instrument items with the Likert scale

| Num. | Answer | Score |
|---|---|---|
| **1** | Very worthy | 4 |
| **2** | Worthy | 3 |
| **3** | Less Worthy | 2 |
| **4** | Not Worthy | 1 |

**Table 2. Component and Indicator of Validation Sheet for Material Expert**

| Component | Indicator | Item Number |
|---|---|---|
| **Suitability of material with basic competencies** | Completeness of the material | 2 |
| | Material breadth | 3 |
| **Components of Scientific Literacy** | Science as A body of knowledge | 7 |
| | Science as a way of investigating | 5 |
| | Science as a way of thinking | 7 |
| | The interaction among science, technology and society | 2 |
| **Total** | | 26 |

**Table 3. Component and Indicator of Validation Sheet for Design Expert**

| Component | Indicator | Item Number |
|---|---|---|
| **Material suitability** | Completeness of the material | 2 |
| | Material breadth | 2 |
| | Depth of material | 4 |
| **Systematics of material delivery** | Systematic delivery of material | 4 |
| **Textbook efficiency** | Centering students in learning | 4 |
| **Language** | Straightforward | 4 |
| | Narrative and concise | 3 |
| **Total** | | 23 |

**Table 4. Component and Indicator of Validation Sheet for Layout Expert**

| Component | Indicator | Item Number |
|---|---|---|
| **Cover design** | Consistent pattern | 1 |
| | Good center of view | 1 |
| | Good color contrast | 1 |
| | Easy to read font size and type | 1 |
| | Writing layout | 1 |
| | The image has a proportional shape | 1 |
| **Content textbook design** | Typography | 1 |
| | Illustration / picture content | 1 |
| | Textbooks | 2 |
| | Layout | 3 |
| **Total** | | 13 |

**Table 5. Component and Indicator of Respond Sheet for Tissue Culture Lecturer**

| Component | Indicator | Item Number |
|---|---|---|
| **Textbook display** | Picture | 1 |
| | Design | 2 |
| | Attractiveness | 1 |
| | Wrinkling | 1 |
| | Clarity of writing | 3 |
| | Language | 6 |
| **The feasibility of material presentation** | Quality of material | 2 |
| | Motivation | 2 |
| | Process in learning activities | 4 |
| | Acquisition of new information | 1 |
| **Scientific Literacy** | Science as A body of knowledge | 7 |
| | Science as a way of investigating | 4 |
| | Science as a way of thinking | 7 |
| | The interaction among science, technology and society | 2 |
| **Total** | | 43 |

**Table 6. Component and Indicator of Respond Sheet for Biology Student in UNIMED**

| Component | Indicator | Item Number |
|---|---|---|
| **Textbook display** | Picture | 1 |
| | Design | 1 |
| | Attractiveness | 1 |
| | Wrinkling | 1 |
| | Clarity of writing | 3 |
| | Language | 6 |
| **The feasibility of material presentation** | Quality of material | 2 |
| | Motivation | 1 |
| | Process in learning activities | 4 |
| | Acquisition of new information | 1 |
| **Total** | | 21 |

Product validation analysis is carried out by converting quantitative data on the Rating Scale into qualitative data, namely adding up the scores of each statement item from each aspect of the assessment, calculating the average total score of each aspect, converting the average score into a percentage, and converting it into a feasibility category based on 4 scale

conversion guidelines. Components and indicators of each assessment for material expert in Table 2, design expert in Table 3, layout expert in Table 4, for lecturer responses in Table 5 and Biology students responses in Table 6. Then conclude the five tables that textbook of tissue culture based on scientific literacy are said to be feasible to use if they are in the "Worthy" and "Very Worthy" criteria. From the calculation results using the above formula obtained the number in the form of a percent (%).

**Result and Discussion**

Development of tissue culture textbook based on scientific literacy is carried out gradually using Dick and Carrey development model consisting of 10 stages, namely: (1) analysis of needs and goals; (2) learning analysis; (3) student analysis and context; (4) formulate the objectives of performance; (5) develop instruments; (6) develop learning strategies; (7) develop and select learning materials; (8) design and conduct formative evaluations; (9) revise; (10) conduct a summative evaluation. But this research is limited to the eighth stage, namely designing and conducting formative evaluations. This restriction is done because after the eighth step has been implemented, researchers have obtained answers from the formulation of problems that have been formulated and limited research time.

The first step in this research to develop teaching materials is to conduct a needs analysis. The needs analysis was carried out by researchers based on the steps for developing teaching materials described in method. Researcher conducted a needs analysis by distributing questionnaires to Biology Study Program students in UNIMED. The title of the questionnaire that was distributed was the Student Needs Analysis Questionnaire of the Tissue Culture Textbook. According to Sucahyanti, *et al*. (2018: 115) needs analysis is intended to find out how much learning materials is needed to be developed.

After the researcher has finished analysing the needs and objectives, the researcher conducts a learning analysis as the second stage in the development of the Dick and Carrey model. This learning analysis is carried out to find out what aspects must be mastered by students. The learning aspect in question is the learning achievement that has been stated in the semester learning plan. Learning outcomes that must be mastered know the composition of tissue culture media, types of tissue culture media, making tissue culture media, and the concept of protoplast culture.

The results obtained from the analysis of student needs that the level of scientific literacy of students is still low. This can be seen in the 2018 PISA results which stated that

Indonesia scored low in the categories of reading, science and math skills. Indonesia is ranked 74$^{th}$ out of 79 countries assessed. Students who were assessed also experienced difficulties in understanding the concept of protoplast culture. The difficulties obtained are difficulties in understanding the material, understanding new words, analysing pictures and tables. Therefore, the expected characteristics of students from the development of this textbook are to improve students' scientific literacy, interest in reading, and the ability to analyse images and data displayed in books. Another interest gained from the development of this book is to broaden students' horizons, add book references and cultivate the nature of thinking and investigating. Meanwhile, the analysis of the learning context includes the attitude of students' interest in learning network culture courses and increasing students' literacy levels.

The textbook that will be developed has 2 chapters, namely tissue culture media and protoplast culture. These two chapters have different learning objectives as follows:

a. Chapter I Tissue Culture Media
   - Students are able to explain tissue culture media, what components must be in the media, and the types of media used in tissue culture.
   - Students are able to make tissue culture media using materials available in the tissue culture laboratory.
   - Students are able to explain the media sterilization process and the media selection process.

b. Chapter II Protoplast Culture
   - Students are able to distinguish what is protoplast culture and protoplast fusion
   - Students are able to understand what processes are carried out in conducting protoplast culture
   - Students are able to explain the application of protoplast fusion in human life

In the development stage of this assessment instrument, researcher developed aspects and indicators in the validation and response questionnaires that were used to determine the assessment of the textbooks that had been developed. In order for this instrument to be used, the researcher needs to validate the developed instrument. After the instrument has been validated, the instrument is feasible to use to get an assessment from the validator, lecturer responses, and student responses. The development of this learning strategy is in line with the formulation of performance goals because it is related to student learning outcomes. The

textbook that will be developed has 2 chapters, namely tissue culture media and protoplast culture. These two chapters have different learning objectives.

In developing and selecting learning materials, the researchers making the design of teaching materials which include layout designs, pictures, and writings. According to Dwipayanti *et al*. (2020: 89), that the development is the stage where all the components needed are assembled in accordance with each purpose. After the six steps above have been carried out, the next step is the selection of media that is in accordance with the developed book. At this stage, the development, preparation, and manufacture of tissue culture textbooks based on scientific literacy are carried out specifically for tissue culture media and protoplast culture materials. The next step is to choose the book format. The paper size used in the manufacture of science literacy-based tissue culture textbooks is A4 paper (21 × 29.7 cm) and the typeface used is Times New Roman with a size of 12 pt. Then the next step is to design an initial draft of the book which begins with determining the chapters to be written. The results of the design format for a tissue culture textbook based on scientific literacy can be seen in Table 7 below:

Table 7. Design of Textbooks Based on Scientific Literacy

| **Title of Book: Buku Ajar Kultur Jaringan Berbasis Literasi Sains** |
|---|
| **Kata Pengantar** |
| **Daftar Isi** |
| **Daftar Gambar** |
| **Daftar Tabel** |
| **Pendahuluan** |
| **Bab I Media Kultur Jaringan** |
| **Bab II Kultur Protoplas** |

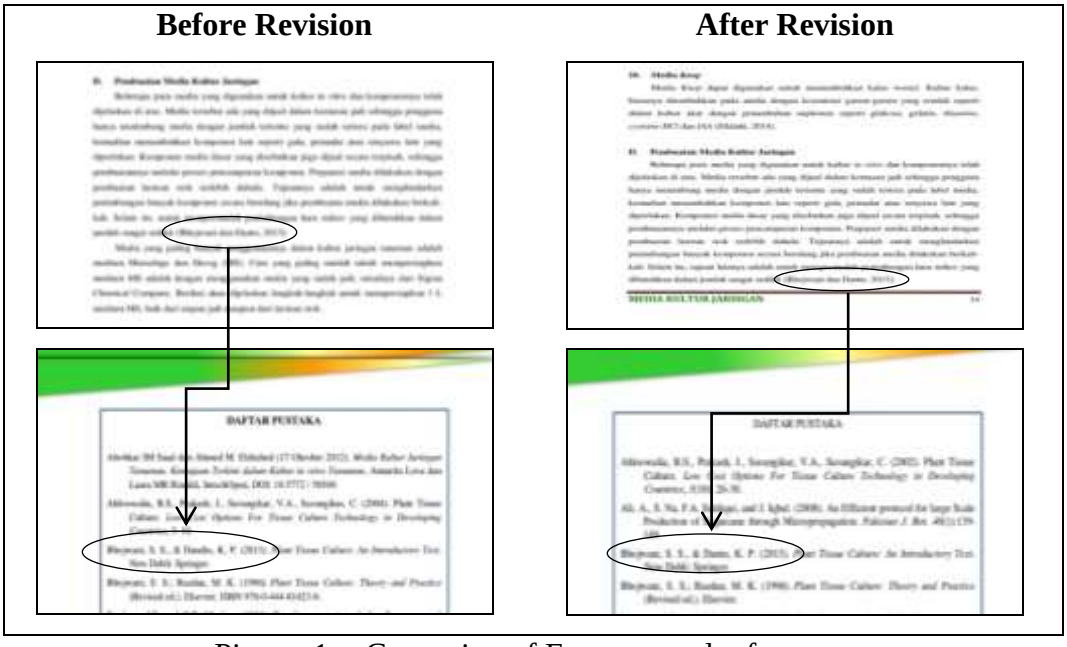
After developing and selecting learning materials in this tissue culture textbook, the next step is a study by expert practitioners, namely validation by material experts, learning experts, and layout design experts. After the book has been validated, the next step is to look at the responses of the lecturers who support tissue culture courses and students regarding the tissue culture textbook based on scientific literacy that have been developed.

Table 8. Results of Validation of Tissue Culture Textbook Based on Scientific Literacy on the Topic of Tissue Culture Media and Protoplast Culture by Material Expert, Learning Design Expert and Layout Design Expert

| Validation | Average Score Validator | Percentage | Criteria |
|---|---|---|---|
| **Material Expert** | 3,69 | 92,3% | Very worthy |
| **Learning Design Expert** | 3,26 | 81,5% | Worthy |
| **Layout Design Expert** | 3,77 | 94,2% | Very worthy |

a. Feasibility Based on Material Expert Validation

The material expert validation assessment of tissue culture textbook based on scientific literacy materials was given by Mr. Dr. Syahmi Edi., M.Si. Based on the expert's assessment of tissue culture textbook based on scientific literacy material, it is assessed in terms of content feasibility (the suitability of the material with basic competencies and scientific literacy components can be seen in Table 8. The average score of assessment from material expert validators is 3,69 or 92,3% with very worthy criteria. The book has been revised based on the advice of material experts in the field of tissue culture. Improvements made are customizing citations with bibliography that can be seen in Picture 1.




Picture 1. Correction of Footnote and references

b. Feasibility Based on Learning Design Expert Validation

The learning design expert validation assessment of tissue culture textbook based on scientific literacy materials was given by Mrs. Dr. Aswarina Nasution, M.Pd. Based on the assessment by the learning design expert for the tissue culture textbook based on scientific literacy, it is assessed from the components of the suitability of the material, the systematics of material delivery, the efficiency of the textbook and the language can be seen in Table 8. The average score of the assessment of the learning design expert validator is 3,26 or 81,5% with worthy criteria. The book has been revised based on the advice of learning design experts. Improvements made are adding questions C4 – C6 in the evaluation section that can be seen in Table 9.

Table 9. Revision from Learning Design Expert add questions C4 – C6 in the evaluation section

| **Before Revision** | **After Revision** |
|---|---|
| Untuk membuat media tanam menjadi padat digunakan bahan….<br>a. Gula<br>b. Tanah<br>c. Pasir<br>d. **Agar**<br>e. Es batu | Makronutrien adalah unsur yang diperlukan oleh tumbuhan dalam jumlah yang banyak untuk proses pertumbuhannya. Mikronutrien adalah unsur yang dibutuhkan dalam jumlah kecil, namun, mikronutrien memainkan peran penting dan masif dalam pertumbuhan sel dan jaringan.<br>1. $NH_4NO_3$<br>2. $KH_2PO_4$<br>3. $CoCl2{\cdot}6H_2O$<br>4. $H_3BO_3$<br>5. $NaH_2\ PO_4\ .H_2\ O$<br>6. $Na_2EDTA$<br>7. KCl<br>8. KI<br>Dari beberapa nutrien di atas yang termasuk ke dalam makronutrien adalah …<br>a. 1, 2, 3, 4<br>**b. 3, 5, 6, 8**<br>c. 1, 3, 5, 7<br>d. 1, 2, 4, 7 |

| | |
|---|---|
| | e. 2, 6, 7, 8 |

c. Feasibility Based on Layout Design Expert Validation

The layout design expert validation assessment of tissue culture textbook based on scientific literacy materials was given by Mr. Adek Cerah Kurnia Aziz, S.Pd., M.Pd. Based on the assessment by the layout design expert for tissue culture textbook based on scientific literacy, it can be seen from the components of the cover design and content design of the textbook, which can be seen in Table 8. The average score of the layout expert validators is 3,77 or 94,2% with very worthy criteria. The book has been revised based on layout design expert suggestions. Improvements made are revising the design of the front cover of the textbook namely using the correlate picture with the topic, revise the font of text that can be seen in Picture 2.


Picture 2. Front cover of textbook before and after revision

Table 10. Response Results of Tissue Culture Textbook Based on Scientific Literacy on the Topic of Tissue Culture Media and Protoplast Culture by Lecturer of Tissue Culture Course and Students in Department of Biology, UNIMED

| Respondent | Average Score Response | Percentage | Criteria |
|---|---|---|---|
| **Lecturer** | 3,80 | 94,8% | Very worthy |
| **Biology Students** | 3,52 | 90,6% | Very worthy |

d. Responses of Lecturer of Tissue Culture Course

The responses of tissue culture lecturer assessment of tissue culture textbook based on scientific literacy materials was given by Mrs. Dr. Tumiur Gultom, M.P. The response of

the lecturer in the tissue culture course in UNIMED aims to find out the interest in tissue culture books based on scientific literacy specifically on the topic of tissue culture media and protoplast culture. The components assessed are the display of textbooks, presentation of material and scientific literacy which can be seen in Table 9. On average, it can be seen from the assessment of the tissue culture course lecturers at 3,80 or a 94,8% with very worthy criteria. Results based on the tissue culture course lecturer, it can be said that the tissue culture book based on scientific literacy specifically on the topic of tissue culture media and protoplast culture has been well developed. Therefore, the book can be used as an additional book for students in the learning process of tissue culture courses. The book has been revised based on layout design expert suggestions. Improvements made are Improved Picture 8 in the textbook by turning it into a schematic picture and using arrows to make the media making process easier to understand. This improvement can be seen in Picture 3.


Picture 3. Design of picture 8 in textbook before and after revision

e. Student Response

Student assessment activities on books that have been developed have been done in Department of Biology, UNIMED namely in class Biology Non Kependidikan C 2019.

Student responses aim to find out student responses to interest in tissue culture books based on scientific literacy specifically on the topic of tissue culture media and protoplast culture. The components that are assessed are the appearance of the book and the presentation of the material. The average results of student responses on each component of the assessment can be seen in Table 9. The average score for the assessment of students is 3,52 or 90,6% with very worthy criteria. Based on student results, it can be said that the science literacy-based tissue culture book specifically on the topic of tissue culture media and culture protoplasts has been well developed. Therefore, the book can be used as an additional book for students in the learning process of tissue culture courses.

The results of the development of a tissue culture textbook based on scientific literacy are included in the very worthy category. In the process of assessing this textbook, from 3 validators and 2 types of respondents, the results were 3.69; 3.26; 3,77; 3.80; 3.52. This proves that textbooks are appropriate to be used as learning resources for tissue culture courses, both as main books and supporting books. The material presented in this book contains relevant theories to explain concepts and principles in tissue culture. In addition, this book clearly explains the material on tissue culture media and protoplast culture, practical work relevant to each chapter so that students get a real function from using the book. Referring to Ardhana's (2002) statement that development research is carried out to bridge the gap between researchers and educational practice.

## Conclusion

This development research uses the Dick and Carrey model to produce tissue culture textbook based on scientific literacy on tissue culture media and protoplast culture. The feasibility of this textbook can be seen if the book has been validated by validators who are experts in their respective fields. The validators in question are material expert validator, learning design expert and layout design expert. After the three validators have finished assessing this textbook, then this textbook will be assessed or responded to by tissue culture lecturer and biology students who are taking tissue culture course. The results of each validator and respondent respectively are 92.3%, 81.5%, 94.2%, 94.8%, and 90.6%. From the results of these scores, it can be concluded that the tissue culture textbook based on scientific literacy on tissue culture media and protoplast culture are suitable for use by students as learning materials, either as main books or as supporting books.

**Closing**

Thanks to the Thesis Supervisor, validators (material expert, learning design expert, layout expert, and lecturer respondents), and student respondents who have contributed to the implementation of this research.

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