

# The Development of Tissue Culture Textbook on Callus Induction of Mangosteen (*Garcinia mangostana* L.) Based on Research

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**Abstract**— The purpose of this research is to develop textbook based on research of callus induction of mangosteen (*Garcinia mangostana* L.) for tissue culture course. This research used a 4D development model adapted from Thiagarajan and was conducted until design stage only. The data were obtained starting from the needs analysis, product design and product manufacturing. The instrument used to collect the research data development used a questionnaire and interview guidelines. This type of research is descriptive research. The results of the needed analysis showed that students support to developed textbook about callus induction of mangosteen (*Garcinia mangostana* L.). Result of development is a textbook draft on callus induction of mangosteen (*Garcinia mangostana* L.) from design phase. **Keywords**— development; textbook; 4D; callus induction

## I. INTRODUCTION

The development and progress of science and technology, especially biology and the development of increasingly sophisticated information systems are two things that must be considered by formal education institutions, especially universities, in order to provide information and actual development of students <sup>[15]</sup>. Educational institutions must develop science and technology in students because it is the learning achievement of the Indonesian National Qualification Framework (IQF) at level 6, that is students are required to be able to apply their expertise and utilize science and technology in their fields in solving problems and be able to adapt to the situation at hand <sup>[7]</sup>.

Every development of science and technology will impact on the content components of the course and related teaching materials <sup>[10]</sup>. The types of courses in the field of biology that are affected by the development of science and technology are usually those related to laboratory equipment, the development of the latest molecular technologies and analyzes, such as genetics, physiology, evolution, cell biology, taxonomy and tissue culture. One of the subjects must follow the development of science and technology at the State University of Medan is Network Culture. Callus induction is one technique in tissue culture. The course studies methods to isolate plant parts such as protoplasm, cells, tissues and organs and then grows them in the right media and aseptic conditions,

so that these parts can multiply and regenerate into complete plants <sup>[5]</sup>.

In connection with the use of science and technology, in order to understand callus induction techniques students must have knowledge of the processes that must be carried out in inducing callus, starting from the sterilization of tools, materials and media, the process of making planting media to callus induction process. The problem that arises is that tissue culture courses in the Biology Study Program and Biology Education University of Medan have not been specifically discussed so that students' understanding of callus induction techniques is still lacking.

The IQF curriculum explains that students are required to be able to apply concepts in everyday situations. Therefore learning tissue culture on callus induction material must be contextual. Contextual learning will help students to make a thread between theoretical studies of books and real reality so as to strengthen students' understanding of concepts in textbooks that are very abstract to a more real level of understanding <sup>[4]</sup>. Therefore it is necessary to use callus induction material textbooks which can involve the development of the latest and contextual science and technology.

One type of textbook that can involve the development of science and technology in studying callus and contextual induction material is the textbooks based on research. Textbooks are books that contain a result of an analysis of the curriculum in written form, systematically arranged and used by students to study and provide facilities for learning activities, both about the substance and the presentation <sup>[3, 8, 13]</sup>. The development of the textbook based on research is expected to help students to know the development of research and the latest discoveries related to the material being discussed and can expand and deepen the material applicatively <sup>[14, 17]</sup>. In addition, the use of research results as learning resources arranged in textbooks can provide real experiences for students <sup>[12]</sup>.

This research purpose to develop textbook as an enrichment book based on research on callus induction of mangosteen (*Garcinia mangostana* L.) in tissue culture

courses at Medan State University. This book is equipped with material about techniques on callus induction of mangosteen (*Garcinia mangostana* L.) and the results of the research on callus induction of mangosteen (*Garcinia mangostana* L.) analysis as a contextual example. The results of the research used in this research were the analysis time of formation callus, fresh weight of callus, height of callus, area of callus and morphology of callus. The enrichment book was compiled by adapting the 4D development model by <sup>[16]</sup> consisting of four stages, namely define, design, develop, and disseminate. This development model was chosen because the 4D concept was considered to be simpler, but included all the stages that were also contained by other development models and provided many clues in the process of developing a learning product.

## II. MATERIALS AND METHODS

This research is a research and development (*R & D*). The product developed was the textbook in course tissue culture based on research with the discussion on callus induction of mangosteen (*Garcinia mangostana* L.). The title used in the textbook compiled is Callus Induction Of Mangosteen (*Garcinia mangostana* L.). The material contained therein is the result of the research described earlier. This type of research is descriptive research. The development model chosen was the 4D development model by <sup>[16]</sup>. This model consists of four stages of development, including define, design, develop, and disseminate. However, this research and development was only carried out at the design stage, which is at the stage of producing a textbook draft on callus induction of mangosteen (*Garcinia mangostana* L.).

The first stage in this development model is the define stage, which aims to define learning conditions. This stage includes needs analysis conducted on students, interviews with lecturers, as well as studies on descriptions of tissue culture courses. The second stage is design, aiming to design a draft textbook based on the results of the research. This stage includes the selection of media in the form of books, the selection of content formats in the book, while in the research on callus induction of mangosteen (*Garcinia mangostana* L.) as for the stages is designing a research on callus induction of mangosteen (*Garcinia mangostana* L.), selection media on callus induction of mangosteen (*Garcinia mangostana* L.), conducted a research on callus induction of mangosteen (*Garcinia mangostana* L.) and the final stage of the design stage was a product design from the textbook on callus induction of mangosteen (*Garcinia mangostana* L.) developed.

## III. RESULT AND DISCUSSION

The textbooks developed are textbooks for students that are used in tissue culture courses on callus induction material. Textbooks were developed based on the results of laboratory research on the callus induction of mangosteen (*Garcinia mangostana* L.). The development model used was the 4D development model by <sup>[16]</sup>. The results of each stage of development that have been carried out are described as follows.

### Define

The results of the need analysis in the form of questionnaires to 30 students who have taken tissue culture courses, 73% of students said they did not know about callus induction and how to do it in tissue culture this was because the tissue culture book they used had not explained it. This is also reinforced by the results of observations that show that during class discussions, the material displayed is theoretical and not accompanied by examples like of callus induction techniques. In addition, students use information from the internet that has no clear source. Based on the results of filling out the questionnaire, 77% of students stated that they had never used the textbooks based on research and 97% of students stated that they needed a tissue culture book based on research and agreed that a tissue culture book based on research specifically discussed callus induction of mangosteen (*Garcinia mangostana* L.) developed as an additional book for students. Furthermore, the lecturers agreed that research on callus induction of mangosteen (*Garcinia mangostana* L.) could be developed in the form of textbooks for tissue culture subjects. The results of this needs analysis are the basis for the development of textbook based on research on callus induction of mangosteen (*Garcinia mangostana* L.).

### Design

The results of the design stage are the design of textbooks and the results of research on the callus induction of mangosteen (*Garcinia mangostana* L.) in the laboratory. The design of textbook on callus induction of the mangosteen (*Garcinia mangostana* L.) was prepared with the content design of textbooks in Table 1.

TABLE 1. The Content Design Of Textbooks

<b>Title Of Book: Callus Induction Of Mangosteen (<i>Garcinia mangostana</i> L.)</b>	
Foreword	
Table Of Contents	
List Of Figures	
List Of Tables	
Chapter I	Introduction
Chapter II	Mangosteen ( <i>Garcinia mangostana</i> L.)
Chapter III	Plant Tissue Culture
Chapter IV	Laboratory Of Plant Tissue Culture
Chapter V	Aseptic Techniques
Chapter VI	Plant Media
Chapter VII	Shoots Induction Of Mangosteen ( <i>Garcinia mangostana</i> L.)
Chapter VIII	Callus Induction Of Mangosteen ( <i>Garcinia mangostana</i> L.)
Chapter IX	Secondary Metabolit Callus Of Mangosteen ( <i>Garcinia mangostana</i> L.)
Chapter X	Results Of Analysis Data
Chapter XI	Closing
References	
Glossary	
Index	

The final results of the development callus induction of the mangosteen (*Garcinia mangostana* L.) based on research at the design stage can be seen in Figure 1.

this textbook is A4. Visuals in the form of images in this teaching material were supported by various photos of research activities and from journals and textbooks as support.

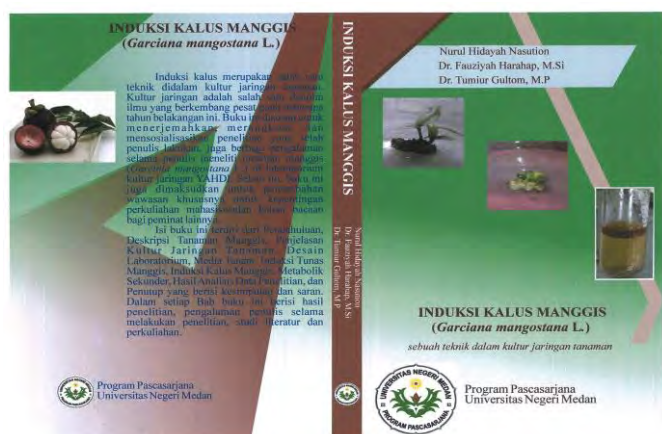


Fig 1. Cover Of Book

### Product identity:

Title : Callus Induction Of Mangosteen (*Garcinia mangostana* L.)

Targets : Biology and Biology Education Students

Author : Nurul Hidayah Nasution, Fauziyah Harahap, Tumtur Gultom

### Characteristics:

The text used in this textbook is type of century with various text sizes according to user needs. The paper used in

### Fill in the material

The material contained in the textbook is the material on callus induction of mangosteen (*Garcinia mangostana* L.), including understanding, principles, techniques and research results. The development of textbook based on research on callus induction of mangosteen (*Garcinia mangostana* L.) in the laboratory is expected students get new knowledge about the techniques performed in the analysis on callus induction of mangosteen (*Garcinia mangostana* L.) and secondary metabolite production from callus of mangosteen (*Garcinia mangostana* L.). The knowledge conveyed to students in accordance with the competency indicators that have been formulated so that the objectives of learning are achieved.

Textbook has a strategic role in facilitating the smoothness of the learning process. Textbooks are one of the teaching materials for students as a provision of basic knowledge, and are used as a learning tool in the scope of lectures. Books compiled in relation to the curriculum should pay attention to the specific objectives to be achieved through education conducted using relevant textbooks. Therefore, before the textbook is developed, the author must first understand the purpose of the education unit, the educational objectives and the scope of the semester material, class or specific education unit [9].

Textbook on callus induction of mangosteen (*Garcinia mangostana* L.) based on research in tissue culture is not yet feasible to use, because it has not been the through the

development stage. Which has not been validated by content experts of Tissue Culture, media experts and design as well as medium group student tests. Based on the regulation of the Minister of National Education number 2 of 2008, explained that textbooks should be suitable for teaching materials and there are also standard quality criteria for textbooks including, 1) content / material feasibility, 2) presentation eligibility, 3) language feasibility, 4) feasibility of grading. These criteria are listed in the components of the validation sheet that are assessed by the validator.

The textbook that was developed is the result of the research on callus induction of mangosteen (*Garcinia mangostana* L.) which is poured into learning material for students so that students can understand the basic principles of tissue culture that produce callus, in accordance with the indicators that will be achieved in the semester learning plan. This textbook is supported by relevant theories that aim to explain the principle of callus induction. In addition, in this textbook also explains the obstacles faced by the research process with the aim of students having an attitude of not giving up easily when they fail. So that the results of research conducted can benefit students.

This is consistent with <sup>[1]</sup> a statement that development research is carried out bridge research and educational practices. Curriculum development and teaching and learning processes based on research, in various models have developed very well and are believed to be the right choice for today 's pattern of teaching and learning activities. <sup>[2, 6, 11]</sup> similarly provides a very good link between research and teaching in higher education.

The results of textbook that have been developed certainly have advantages and disadvantages. The advantages of textbook that have been developed are, 1) the instructional material is arranged from the results of the study systematically so that the reader gets a direct picture of the stages in the study, 2) teaching materials supplemented with learning objectives so as to guide students in learning activities, 3) material presented using language that is simple and easily understood by students, 4) teaching materials are arranged systematically starting from the material, stages in the research and exposure to research data so as to facilitate students in studying the textbook, 5) teaching materials can be read anywhere and can also be understood without explanation from the lecturer. The disadvantages in textbook that have been compiled contain only one basic competency because they are used as supporting teaching materials for tissue culture courses and also this textbook has not been validated by experts due to time constraints.

#### IV. CONCLUSION

The results of the research and development that has been carried out are the design of textbooks entitled Callus Induction Of Mangosteen (*Garcinia mangostana* L.) at the design stage in the 4D development model and the next step is the development stage so that the books developed are suitable for use.

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