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Effectiveness of Application of Tissue Culture Textbook Based on Research on the Critical Thinking Skills of Biology Students at Universitas Negeri Medan

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Abstract. The purpose of this study was to determine the effectiveness of the application of research-based tissue culture textbooks based on the critical thinking skills of students at Universitas Negeri Medan. This type of research was a quasi-experimental study using a pre-test and post-test control group design. The population of this study were all students of the Department of Biology class of 2015. The research sample consisted of two randomly selected classes. In the experimental class, the learning used a research-based tissue culture textbook and the control class used conventional textbooks. The results showed that the research-based tissue culture textbook that had been developed was effective based on critical thinking skills ($Z = 1.301$ and $P = 0.000$). The improvement of students' critical thinking skills (N-Gain score) was 0.47 in the moderate improvement category. Therefore, it can be concluded that the research-based tissue culture textbooks were developed effectively based on students' critical thinking skills.

keywords: critical thinking skills, textbook, tissue culture

1. Introduction

The Indonesian National Qualification Framework (Kerangka Kualifikasi Nasional Indonesia / KKNI), is a competency qualification gap framework which can juxtapose, equalize, and integrate between the education and job training fields as well as work experience in the context of providing work competency recognition in accordance with the work structure in various sectors. Referring to the learning achievements of graduates from KKNI the characteristics of higher education learning processes today are interactive, holistic, integrative, scientific, contextual, thematic, effective, collaborative, and student-centered (Indonesian Ministry of Education and Culture Regulations No. 3 of 2020). Research-based learning is one form of learning that supports the achievement of the IQF goals. To support the success of learning, a textbook is needed that can improve students' critical thinking skills [1-2].

Textbooks are an inseparable part of the learning process both in school and in college. Textbooks are used as a source of learning by teachers / lecturers in delivering material and determining learning strategies. In addition, students use textbooks as a source of information to understand the material (both for doing homework and assignment). Textbooks are one of the inputs in the learning process



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that also determines the success and achievement of instructional, curricular, institutional, and even national education goals.

In higher education, textbooks are structured to help lecturers and students in lectures. Textbooks are used by lecturers as a reference source in the implementation of the learning process for students [3]. The existence of textbooks in lectures will make it easier for students to obtain the material learned in lectures. In addition, in the learning process in an age of scientific and technological progress, teachers/ lecturers and students cannot only use a handbook, but are required to read various books that are relevant to what will be taught or will be learned[4]. Therefore, the availability of textbooks at the tertiary level is one important component in lectures.

The tissue culture course is one of the subjects that prioritizes the process and research in its learning, so it needs a textbook oriented to these things. The textbook used today supports research activities, but the research developed is still limited to mangosteen plants. In addition, the presentation of information regarding the steps of the research carried out is still not detailed. Therefore Harahap has developed a research-based tissue culture textbook [5].

The development of the textbook has reached the initial pilot phase or main field trial, but has not yet reached the effectiveness testing stage. As it is known that in improving the quality and capability of books, it is necessary to carry out further tests, namely operational field testing. The development research procedure basically consists of two main objectives, namely developing a product (development function), and testing the effectiveness of the product in achieving its goals (validation function)[6]. Therefore this research was carried out with the aim to find out the effectiveness of the book by looking at the effect of the application of research-based tissue culture textbooks that had been developed based on students' critical thinking skills.

2. Methods

This type of research was a quasi-experiment. The research design used was the pre-test and post-test control group design. The research subjects were students majoring in biology at Universitas Negeri Medan the 8th semester. From a number of classes, two classes were determined as the research sample using cluster random sampling technique. In the experimental class, the learning used a research-based tissue culture textbook that had been developed while the control class was taught using a conventional tissue culture textbook (a book commonly used by students of the Department of Biology at Universitas Negeri Medan). In this study, face-to-face meetings were conducted four times for each class.

Tabel 1. Research Design

Group	Pre-test	Treatment	Posttest
Experiment	Pa ₁	X ₁	Pa ₂
Control	Pa ₁	X ₂	Pa ₂

Notes:

X₁ = Learning with research-based tissue culture textbooks

X₂ = Learning with conventional tissue culture textbooks

Pa₁ = Pre-test of critical thinking skill

Pa₂ = Post-test of critical thinking skill

The instrument used in the data collection of student's critical thinking skills was a written test arranged in the form of a description consisting of five indicators of critical thinking skills. Indicators of critical thinking skills include (1) basic clarification; (2) basic skills; (3) summarizing skills; (4) advanced clarification skills; (5) strategy and tactics[7].

Research-based textbook that have received input from experts and users then applied in the learning process to determine the effectiveness. The effectiveness of textbooks was assessed based on the comparison of the critical thinking skills of the experimental class with the control class. Assessment of critical thinking skills through giving pre-test and post-test questions that have been validated by material experts and Biology lecturers. Students were first given pre-test questions before

learning to use textbooks. The lecturer then provided the subject matter using textbooks. After learning using textbooks, the teacher gave the same test questions as the pre-test. The pre-test and post-test scores that have been obtained were then analyzed by using the Mann-Whitney and N-Gain test formulas. The Mann-Whitney test was used to calculate whether the improvement in critical thinking skills was significant or not, while N-Gain was used to calculate the improvement in critical thinking skills, but before being tested, the prerequisite test of data normality and homogeneity was conducted first.

3. Results And Discussion

Table 2. shown that the post-test average score of critical thinking skills of students taught using research-based textbooks (68.88 ± 8.19) were higher than the average score of students taught using conventional textbooks (52.72 ± 8.86). The standard deviations between the two groups were not much different. These conditions indicate that the critical thinking skills of students in the experimental and control groups after treatment showed an even increase in each group.

Table 2. The results of the test of differences in students' critical thinking skills using research-based textbooks and conventional textbooks

Group	N	Mean	S.D.	Z _{score}	P
Experimental	32	68.88	8.19	1.301	0.000
Control	32	52.72	8.86		

The improvement of students' critical thinking skills was seen from the results of the N-gain calculation of the pre-test and post-test scores between the experimental class and the control class. The results of the analysis were presented in Table 3.

Table 3. N-Gain score of experimental and control classes

Class	N-Gain	N-Gain Interpretation
Experimental	0,47	Moderate
Control	0,17	Low

Based on Table 3, it was known that the interpretation of increasing students' critical thinking skills in the experimental class was moderate and the control class was low. The N-gain score of the experimental class was 0.47 while the N-gain score of the control class was 0.17.

A description of the post-test score of critical thinking skills based on indicators of critical thinking skills developed by Ennis in classes taught using research-based and conventional textbooks was stated in Figure 1.

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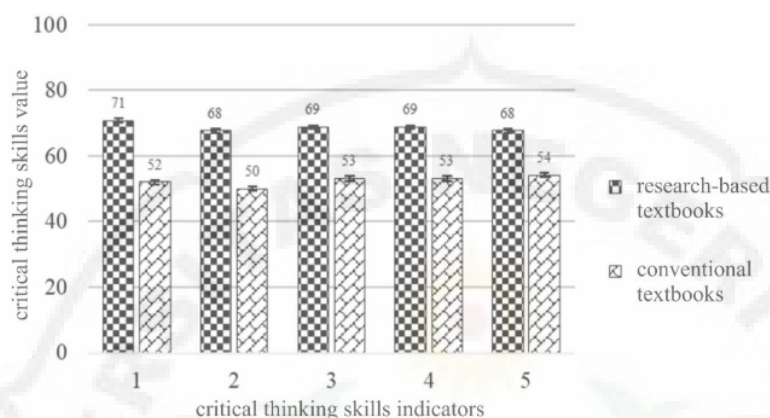


Figure 1. Differences in students' critical thinking skills taught using research-based textbooks and conventional textbooks based on indicators of critical thinking skills.

Notes:

1. Basic clarification
2. Basic skills
3. Summarizing skills
4. Advanced clarification skills
5. Strategy and tactics

Based on statistical tests, it was known that there were significant differences in the use of research-based tissue culture textbooks based on students' critical thinking skills. The test results showed that students who use research-based tissue culture textbooks had a higher average score (68.88 ± 8.19) compared to students who use conventional textbooks (52.72 ± 8.86). The standard deviations between the two groups were not much different. These conditions indicate that the critical thinking skills of students in the experimental and control groups after treatment showed an even increase in each group.

Furthermore, the results of research showing the effectiveness of the use of research-based textbooks based on critical thinking skills can be seen from the average N-gain scores of all students. The average N-gain of critical thinking skills in experimental group students using research-based tissue culture textbooks was 0.47 with moderate qualifications. Whereas in the control group, the normalized gain score obtained was 0.17 with low qualifications. Based on these data, there was a descriptive difference that research-based network culture textbooks are effective based on students' critical thinking skills.

The ability of students to analyze a concept will reflect how much the student's ability to think was the basis of a learning process. The indicators used in measuring students' critical thinking skills in this study refer to the indicators developed by Ennis. Indicators of critical thinking skills were basic clarification, basic skills, summarizing skills, advanced clarification skills, and strategies and tactics.

Reviewing the results of the tests given to the two groups of students after participating in the study, obtained data on critical thinking skills in the form of the average score per indicator measured. In the experimental group the highest average score indicator of critical thinking skills of students to the lowest is basic clarification (71), summarizing skills (69), advanced clarification skills (68), basic skills (68), strategy and tactics (68). In the control group the highest average score indicators of critical thinking ability of students to the lowest were: strategy and tactics (54), summarizing skills (53), advanced clarification skills (53), basic clarification (52), basic skills (50). The used of research-based textbooks in the experimental group can improve five indicators of critical thinking skills. Although it

increased significantly compared to the control class, the average score obtained from each indicator was interpreted at a sufficient level (68.88 ± 8.19).

Students who use research-based tissue culture textbooks were more critical in solving problems, ranging from understanding problems to finding the right solution and re-examining the results that have been obtained. In the process, they form their own knowledge and can deduce better. By using research-based textbooks students showed positive responses, encouraging them to be more active in discussing peers and actively asking lecturers. The use of appropriate teaching materials was able to encourage students to solve the problems discussed in their groups and make it possible to analyze their thoughts in making choices and draw conclusions intelligently[8].

The use of research-based tissue culture textbooks in contextual learning arrangements was significantly effective based on students' critical thinking skills. This was based on the advantages possessed by research-based tissue culture textbooks. As for the advantages of this book were; (1) the material presented in this textbook did not only come from literature reviews from books, articles, national and international journals, but also comes from research results that have been conducted through direct research; (2) a research-based tissue culture textbook contains activities that contain complete research methods and results, for example in learning tissue culture courses, which were expected to help students understand ideas, concepts and research theory as a guide in understanding and conducting similar research or further research; (3) learning activities were arranged systematically to make it easier for users to study textbooks independently.

The findings obtained in this study were in line with the results of similar studies before. Inquiry-based microbiology teaching materials developed were effective in increasing students' critical thinking skills[9]. Lesmono in his research concluded that interactive teaching materials can improve critical thinking skills[10]. Furthermore according to Chrysti that research-based learning can train students to think critically in conducting research activities such as observing, arranging hypotheses, collecting data, processing data, and making conclusions[11]. According to Wahyuni learning using lesson study can improve critical thinking skills[12]. According to Umar research-based learning is able to provide opportunities for students to develop intellectual concepts that emphasize the real situation with the stages that must be passed to discover new things from the process of conducting research[13].

4. Conclusion

The results showed that research-based tissue culture textbooks were developed effectively based on critical thinking skills ($P = 0,000$). Increased students' critical thinking skills showed an average score of N-Gain of 0.47 with a moderate increase category. Therefore, it can be concluded that research-based tissue culture textbooks were developed effectively based on critical thinking skills.

References

- [1] Kartika Y, Wahyuni R, Sinaga B, Rajagukguk J. Improving Math Creative Thinking Ability by using Math Adventure Educational Game as an Interactive Media. In Journal of Physics: Conference Series 2019 Jul (Vol. 1179, No. 1, p. 012078). IOP Publishing.
- [2] Borg and Gall 2003 *Educational Research an Introduction*, Seventh Edition (United State of America-University of Oregon)
- [3] Priyanto S H 2012 Kriteria Baku Buku Ajar. Presented in the Workshop: *Penulisan Buku Ajar Dosen Kopertis VI*
- [4] Hanifah U 2014 Pentingnya Buku Ajar yang Berkualitas dalam Meningkatkan Efektivitas Pembelajaran Bahasa Arab, *Jurnal Ilmu Tarbiyah "At-Tajdid"* volume 3 pp 99-121
- [5] Harahap N K 2018 Pengembangan Buku Ajar Berbasis Riset Induksi Kalus dan Kemampuan Regenerasi Tanaman Nanas (*Ananas comosus* L.) Asal Sipahutar Melalui Teknik In Vitro pada Mata Kuliah Kultur Jaringan Tanaman di Universitas Negeri Medan. *thesis*. Medan: Postgraduate school Universitas Negeri Medan.

- [6] Jonny HP, Rajagukguk D, Rajagukguk J. Computational Modelling Based on Modellus to Improve Students' Critical Thinking on Mechanical Energy. In *Journal of Physics: Conference Series 2020 Jan* (Vol. 1428, No. 1, p. 012042). IOP Publishing.
- [7] Ennis R H 1985 *A Logical Basis for Measuring Critical Thinking* pp 45-54
- [8] Hidayaturohman R 2017 Pengembangan Bahan Ajar Interaktif Fisika Berwawasan SETS untuk Meningkatkan Kemampuan Berpikir Kritis Siswa *Seminar Nasional Pendidikan Fisika Universitas Jember*
- [9] Lestari P B Triasih W H 2019 Pengaruh Bahan Ajar Mikrobiologi Berbasis Inkuiri terhadap Kemampuan Berpikir Kritis Mahasiswa IKIP Budi Utomo Malang. *Edubiotik: Jurnal Pendidikan, Biologi dan Terapan* volume 4 pp 22-28
- [10] Lesmono A D 2017 Pengembangan Bahan Ajar Interaktif Fisika Berwawasan SETS untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. *Seminar Nasional Pendidikan Fisika*
- [11] Chrysti K 2013 Implementasi Pembelajaran Berbasis Riset Kajian: Fermentasi Limbah Cucian Beras (Leri) untuk Pembuatan Nata pada Mata Kuliah Konsep Dasar IPA Mahasiswa S1 PGSD FKIP UNS *Seminar Nasional XI Pendidikan Biologi FKIP UNS Semarang*
- [12] Wahyuni S Eko S ang Roimil L 2015 Peningkatan Kemampuan Berpikir Kritis Mahasiswa Pendidikan Biologi UMM Melalui Lesson Study *JINoP (Jurnal Inovasi Pembelajaran)* volume 1 p 2
- [13] Umar M K 2011 *Pengembangan Pembelajaran Berbasis Riset di Program Studi Pendidikan Fisika FMIPA Universitas Negeri Gorontalo* Universitas Negeri Gorontalo



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