# Analysis of Student's Knowledge, Attitudes, and Skills in Flowering Plants Improvement

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**Abstract.** This study aims to analyze the knowledge, attitude, and skills of students in flowering plant propagation. The cognitive (knowledge), affective (attitude), and psychomotor (skill) aspects studied in this study are important components of the learning process. A descriptive survey design was used with data collection methods through knowledge tests, attitude questionnaires, and observations of practical skills in flowering plant propagation. Samples were taken using purposive sampling techniques from students of the Biology Education study program who had experience in flowering plant propagation. The results showed that most students had a good understanding of the concept of flowering plant propagation, where 85% of students were able to correctly answer questions about generative propagation, and students also had good abilities in answering questions related to vegetative propagation. However, understanding of tissue culture techniques has not been mastered because this material has not been taught practically in the course. Most students (83%) showed a positive attitude towards the importance of flowering plant propagation in the context of environmental conservation and agriculture, although 17% still needed to strengthen their understanding of the benefits of commercial plant propagation technology. In terms of skills, although students can perform generative and vegetative propagation, some students have difficulty in advanced techniques such as grafting and tissue culture, which may be due to limited laboratory facilities. These findings indicate that learning flowering plant propagation in theory and practice has been effective, but reinforcement of tissue culture techniques is needed through intensive training and adequate laboratory facilities. Students' positive attitudes towards flowering plant propagation support the importance of developing more innovative learning strategies to improve student competence in this field by the demands of the workplace.

**Keywords:** flowering plant propagation, knowledge, attitudes, skills, tissue culture, conservation.


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# 1 Introduction

Knowledge, attitudes, and skills are important aspects of the learning process, especially in courses related to biology and flowering plant propagation. The course "Plant Structure and Development" at the Faculty of Mathematics and Natural Sciences, Jakarta State University aims to provide a deep understanding of the morphology, anatomy, physiology, and propagation techniques of flowering plants.

Learning about flowering plant propagation is one of the important aspects of the biology education curriculum. The process of plant propagation, both generatively and vegetatively, has great relevance in various fields such as agriculture, horticulture, and plant conservation. In the context of biology education, students are expected not only to understand the theoretical concepts of plant propagation but also to be able to practice these techniques directly. Therefore, mastery of knowledge, attitudes, and skills in flowering plant propagation is an important aspect that must be achieved in the learning process.[1]

Students' knowledge of flowering plant propagation includes an understanding of natural and artificial propagation mechanisms, such as cuttings, grafting, budding, and tissue culture. According to Riyadi (2015), although vegetative propagation techniques such as cuttings and grafting are often considered easy, more complex techniques such as grafting and tissue culture require deeper understanding and skills, especially in terms of media preparation and sterile conditions.[2]

Student attitudes are also important factors that influence learning success. A positive attitude towards the course will encourage learning motivation and active involvement in the learning process. According to Krathwohl (2002), affective attitudes such as interest and motivation are very influential in achieving optimal learning outcomes. In the context of flowering plant propagation, a positive attitude towards learning materials is expected to increase students' interest in practicing propagation techniques.[3]

In addition, students' practical skills are the main focus of learning plant propagation. These skills include students' ability to apply propagation techniques appropriately and efficiently. A study by Suryadi (2016) showed that practical skills are greatly influenced by the frequency of practice and the use of innovative learning methods. These skills will be important provisions for students who will later enter the world of education or industry related to plants and agriculture.[4]

However, based on initial observations, there is still a gap between the theoretical knowledge and practical skills of students in flowering plant propagation. This is due to several factors, such as limited tools and practical materials, as well as the lack of intensive training in more complicated techniques such as tissue culture. Therefore, research is needed that analyzes in depth how students' knowledge, attitudes, and skills are in learning and practicing flowering plant propagation techniques.

This study aims to analyze students' knowledge, attitudes, and skills in flowering plant propagation. Cognitive (knowledge), affective (attitude), and psychomotor (skills) aspects are important elements in the learning process (Anderson & Krathwohl, 2001). Analysis of these three aspects will provide an overview of the effectiveness of the learning that has been implemented and the need for strengthening in each aspect, as well as being the basis for designing more effective and innovative learning strategies. Thus, the development of student competencies in this field can be more optimal, by the demands of the curriculum and the needs of the world of work.[5]

## 2. Methods

This study uses a quantitative descriptive method with a survey approach to measure students' knowledge, attitudes, and skills. This method involves several stages, namely:

### 2.1 Research Design

Data were collected through knowledge tests, attitude questionnaires, and observation of skills in flowering plant propagation practicums. This study used a descriptive survey design with data collection through questionnaires and direct observation. The study population was students who took courses related to plant structure and development in the Biology Education study program. Samples were taken using purposive sampling techniques to obtain students who had experience in flowering plant propagation.

### 2.2 Population and Sample

The population of the study was Biology Education students taking the course of Plant Structure and Development at the Faculty of Mathematics and Natural Sciences, State University of Jakarta. The research sample consisted of 66-70 students selected by purposive sampling.

### 2.3 Instrument

The instruments used in this study were closed questionnaires and observation sheets.

1. Knowledge test instrument: Measuring students' understanding of the concept of flowering plant propagation, such as generative and vegetative methods, the life cycle of flowering plants, and related technologies.
2. Attitude Questionnaire: Measuring students' attitudes towards the importance of flowering plant propagation and environmental awareness in propagation practices.

3. Skills Observation Sheet: Used to assess students' skills in applying propagation techniques, both generative (such as pollination) and vegetative (cuttings, grafting, and budding).

### 2.4 Procedure

1. Questionnaire: Distributed to students who have attended lectures on flowering plant propagation.
2. Observation: Conducted during the practicum to assess students' skills in applying flowering plant propagation techniques.
3. Open-ended interview: Used to explore factors that influence students' attitudes and skills in the flowering plant propagation process.

### 2.5 Data Analysis Technique

The questionnaire data were analyzed quantitatively using descriptive statistics to measure the percentage and average level of student's knowledge and attitudes. The skills data obtained from the observation sheet were analyzed using a Likert scale to determine the level of skill mastery. The interview results were analyzed qualitatively to understand the factors underlying students' knowledge and attitudes.

## 3. Result and Discussion

### 3.1 Result

**Student Knowledge about Flowering Plant Propagation**

From the test results given to 68 students, it is known that most students have a good level of understanding of the basic concepts of flowering plant propagation. As many as 85% of students were able to correctly answer questions about generative propagation (pollination and seed formation). Students were able to answer questions about vegetative plant propagation (cuttings, grafting, budding) well. This can be seen in Table 1. However, many tissue culture techniques have not been facilitated in this course, although in theory, especially those related to plant structure, plant nutrition, plant hormones, and plant movement have been given.

**Table 1**. Level of Student Knowledge Mastery

| Knowledge Aspect | Level of Mastery |
|---|---|
| Generative propagation | 85% |
| Vegetative propagation | 79% |

**Students' Attitudes Towards Flowering Plant Propagation**

The results of the attitude questionnaire from 66 students showed that most students (83%) had a positive attitude towards the importance of flowering plant propagation in the context of environmental and agricultural conservation. Students realized the importance of utilizing propagation techniques for the conservation of rare species and increasing the productivity of food crops. However, there were about 17% of students were not fully aware of the positive impacts of the application of plant propagation technology in a commercial context. Figure 1 below shows a graph of student attitude scores on plant propagation.

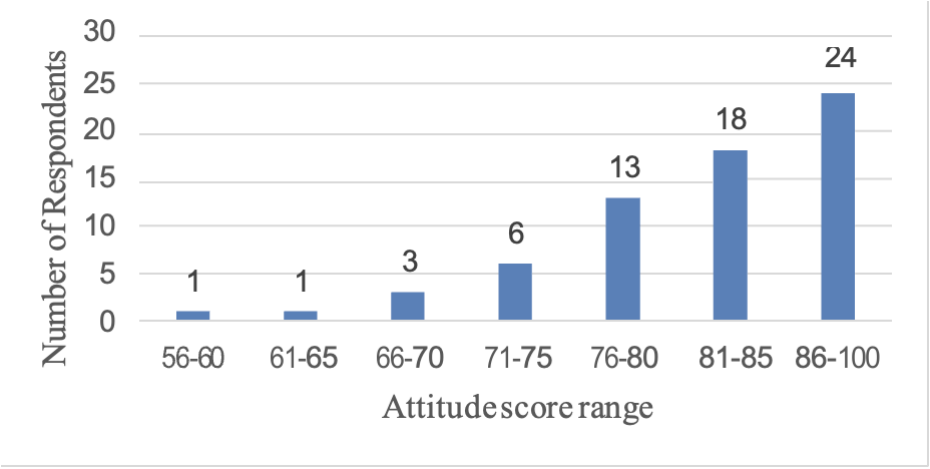


**Fig. 1.** Student Attitudes towards Plant Propagation

**Student Skills in Flowering Plant Propagation**

From the results of the behavioral questionnaire on 70 students in flowering plant propagation, as many as 93% of students have positive behavior toward the importance of flowering plant propagation. While 7% of students still need guidance. In Figure 2 below there is a graph of student behavior scores in plant propagation.

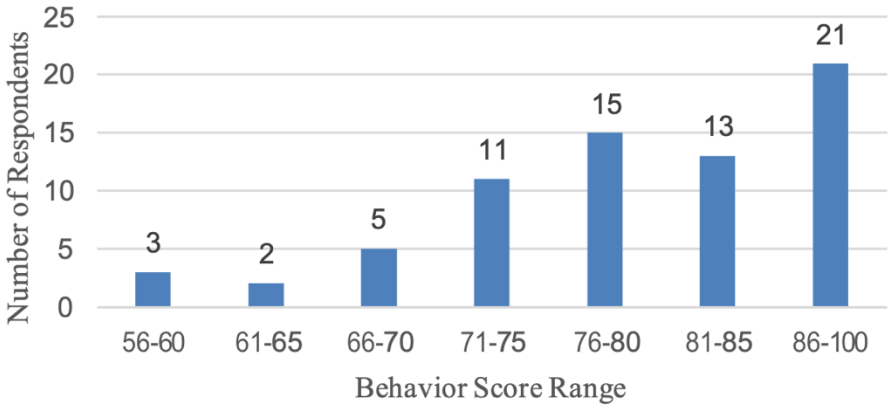


**Fig. 2.** Student Attitudes towards Plant Propagation

### 3.2 Discussion

**Student Knowledge about Flowering Plant Propagation**

The high level of student's knowledge about generative and vegetative propagation shows that theoretical and practical learning in class is quite effective. However, further understanding of tissue culture techniques is needed to strengthen this material. Tissue culture is an important method in plant biotechnology that requires deeper knowledge and careful laboratory skills. According to Ginting (2017), "tissue culture is a plant propagation technique that has great potential to increase the number of plants in mass with uniform quality".[6]

The results of this study indicate that the level of students' knowledge is in the good category with an average score of 82 on a scale of 100. Most students have a good understanding of basic propagation techniques, such as cuttings and grafting. However, students still need more complex techniques, such as tissue culture. This is in line with Riyadi's research (2015) which shows that although students understand the theory in depth, they often have difficulty understanding techniques that require in-depth physiological understanding.[2]

**Students' Attitudes Towards Flowering Plant Propagation**

Most students have a positive attitude towards the importance of flowering plant propagation techniques, especially in the context of environmental conservation and agriculture. This positive attitude shows that students not only understand the importance of flowering plant propagation in an academic context but also its practical relevance to environmental and economic problems. This is in line with the findings of Arifin (2018) who stated that "students' positive attitudes towards plant propagation techniques are closely related to their awareness of the importance of ecosystem conservation and sustainability".[7]

Students' attitudes towards this material are very positive, with 85% of respondents

stating that they are interested and motivated to learn flowering plant propagation techniques. This positive attitude is influenced by students' perceptions of the relevance of the material in the world of work, especially for those who aspire to become biology teachers. According to Krathwohl (2002), a positive attitude can increase students' motivation to learn and involvement in the learning process.[3]

However, 15% of students who do not yet have full awareness of the commercial application of flowering plant propagation technology indicate a need to increase insight into the practical application of plant propagation in the industrial world. Thus, it is necessary to integrate material on the economic impact of using this technology into learning.

**Student Skills in Flowering Plant Propagation**

Observation results show that although the majority of students can perform generative and vegetative propagation, they still face some difficulties in more complicated techniques, such as grafting and budding. This may be due to the lack of adequate practical training and limited laboratory facilities. Sugiyono (2013) explained that "intensive practicums and adequate facility support are needed to improve students' technical skills in plant propagation".[8]

The needs of students in tissue culture techniques also reflect the high demand for special skills needed for this technique. As stated by Haris (2019), "tissue culture requires precise laboratory skills, strict sterilization, and a deep understanding of planting media and environmental factors".[9]

In terms of skills, observation results also show that students have good skills in basic techniques such as cuttings and layering, but only 50% of students are successful in practicing grafting and budding techniques correctly. Tissue culture practices are still very lacking and need to be facilitated. These skills require more intensive training, especially in terms of tool preparation, sterility, and precision in implementation.[1] This shows that even though

## 4. Conclusion

The results of the study showed that students have a good understanding of flowering plant propagation, especially in generative and vegetative propagation. As many as 85% of students were able to answer questions about generative propagation correctly, while their vegetative propagation skills were also quite good. However, tissue culture techniques have not been taught practically, so students' mastery of this technique is still lacking.

In terms of attitude, the majority of students (83%) have a positive view of the importance of flowering plant propagation, especially in the context of environmental conservation and increasing agricultural productivity, although 17% do not fully under-

stand the benefits of this technology in a commercial context.

In terms of skills, most students showed adequate skills in generative and vegetative propagation practices, but more complicated propagation techniques, such as grafting, grafting, and tissue culture, still need strengthening. This can be attributed to the lack of intensive training and limited laboratory facilities.

Overall, learning flowering plant propagation in class has been quite effective, but strengthening is needed in the aspect of advanced skills, especially tissue culture techniques, through improved practices and facilities. The development of more innovative learning strategies is also needed to improve students' competence in flowering plant propagation so that they are better prepared to face challenges in the world of work.

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