KNOWLEDGE LEVEL MAPPING SEED PRODUCTION TECHNIQUES OF FORESTRY PLANTATIONS BASED ON PRETEST AND POSTTEST VALUES

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Abstract. The study aimed to find out the level of knowledge of seed production of forestry plantation crops at the beginning of lectures (pretest) and at the end of classes (posttest) for TIB Bogor and Sukabumi campus students to compare the pretest and posttest scores for these students as well as posttest scores between TIB campus students Bogor with TIB Sukabumi campus students. The research method used as a statistical test tool for the research data used to achieve the research objectives is the paired t-test, the Wilcoxon signed rank test, as the normality assumption test. The results showed an increase in the knowledge of TIB Bogor students during lectures based on the results of the pretest assessment compared to the posttest. Nearly 100% of the student's understanding of seed production techniques for forestry plantation crops increased. In contrast to TIB Sukabumi students, the average posttest score of IPB Sukabumi vocational students was significantly higher than that of pretest me. This matter shows that lectures on seed production techniques for plantation and forestry plants still need to provide strong evidence of increasing knowledge about this for TIB Sukabumi students. So, it is necessary to do further research related to the factors that influence the lecture process. The average score of IPB Bogor students is higher than that of Sukabumi. It is suspected that there are differences in the factors that influence the attainment of this level of knowledge, such as differences in educational background, teaching quality, or student characteristics on both campuses.

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1 Introduction

Seed Production Engineering for Plantation and Forestry Plants (TPBTPK) is one of the subjects studied by students of the Seed Industry Engineering (TIB) study program at the Vocational Schools of the Bogor and Sukabumi campuses. The learning outcomes (LO) of this course are able and skilled in explaining the production of seeds of commercial plantation crops, namely oil palm, rubber, coffee, cocoa, coconut, and tea, starting from their origin, economic value, botany and ecophysiology of cultivation techniques to the procurement of the seeds as well as explaining the production of commercial forestry plant seeds, including teak, acacia, mahogany, albizia. Based on the condition, to achieve the LO of the course, a semester lecture plan is prepared, which is equipped with an assessment rubric to determine the level of student understanding. One of the efforts is to do a pretest before the lecture and a posttest after the class.

The pretest was conducted to determine how far students can master the material or materials to be taught. The posttest is carried out at the end of the lecture process to know the extent to which students understand the material and the critical points of the material being studied [1]. The learning process consists of three stages: assimilation, accommodation and equilibration (balancing). The assimilation process is unifying (integrating) new information into new cognitive structures that already exist in students' minds. The method of accommodation is the adjustment of cognitive systems into a unique situation; the process of equilibration is a continuous adjustment between assimilation and accommodation. The pretest will help integrate (assimilate) students' knowledge before lectures with new information so that the TPBTPK material or materials can be adapted to students' abilities or their cognitive adjustment (accommodation) occurs into new material if students have not mastered it.

In addition to determining the choice of lecture material to be delivered according to student abilities, the pretest and posttest also help lecturers evaluate and improve lecture activities and methods to increase student motivation, interest and readiness for lecture activities to increase learning outcomes. This study attempts to map the increase in knowledge of Seed Production Techniques for Plantation and Forestry Plants obtained by TIB Bogor and Sukabumi class students during lectures over one semester.

The research aims to:
1. Find out the level of knowledge of forestry plantation plant seed production at the beginning of the lecture (pretest), TIB students at the Bogor campus and the Sukabumi campus
2. Determine the level of knowledge of forestry plantation seed production at the end of the lecture (posttest) of TIB students at the Bogor and Sukabumi campuses.
3. Comparing the pretest and posttest scores of TIB students at the Bogor campus and Sukabumi campus
4. Compare the pretest scores between TIB Bogor and Sukabumi campus students.
5. Compare the posttest scores between TIB Bogor and Sukabumi campus students.

2 METHODOLOGY

The research was conducted in the even semester of 2022/2023 at the Bogor campus vocational school and the Sukabumi campus. The object of research is the students of the Seed Industry Technology study program at the two campuses.
2.1 Collection, Data Processing and Statistical Testing

This study used an experimental research method by conducting a pretest and posttest of 100 questions about producing forest plantation plant seeds using crossword puzzles (TTS). The questions given in the pretest and posttest are the same. The data type obtained was primary data, namely pretest and posttest scores of 59 TIB Bogor campus students and 38 TIB Sukabumi campus students. Data on the results of the pretest and posttest scores were processed using Windows Office Microsoft Excel, namely by adding up the scores from the correct student answers; each right TTS question was worth one so that if students answered the TTS questions correctly, they would get a maximum score of 100. The data source for this research is all TIB students who take the Plantation and Forestry Plant Seed Production Engineering course at the Bogor campus and Sukabumi campus.

Data is processed using simple mathematics and statistics: adding, dividing, multiplying and averaging. Statistical test tools for research data used to achieve research objectives are paired t-test and Wilcoxon signed rank test. The use of paired t-test has several assumptions, one of which is the assumption of data normality. If the research data does not meet the normality assumption, non-parametric statistical tests such as the Wilcoxon signed rank test are performed. This method does not assume a normal distribution of data and is suitable for ordinal data or data that is not normally distributed. They answered research objectives 1 and 2 strategies in the form of pretest and posttest questions that TIB students at the Bogor and Sukabumi campuses must answer. Next, corrections were made to the pretest and posttest answer sheets for students from both campuses. Based on this situation, to answer research objectives 3, 4, and 5, paired t-tests and Wilcoxon signed rank tests were carried out.

2.2 Data processing and analysis techniques

The data used in this study is paired data, so the paired t-test will be used to evaluate whether there is a significant difference between the pretest and posttest. The null hypothesis (H0) will be rejected if the p-value resulting from the paired t-test is below the specified level of significance (usually 0.05; otherwise, if the p-value is more significant than 0.05, then the null hypothesis (H0) ) is accepted. One of the assumptions of using the paired t-test is the assumption of normality of the data. If the data does not meet the normality assumption, non-parametric statistical tests such as the Wilcoxon signed rank test can be performed. This method does not assume a normal distribution of the data and is suitable for data ordinal or data that is not normally distributed.

3 RESULTS AND DISCUSSION

3.1 Pre-test and post-test scores for TIB Bogor students

3.1.1 Pretest and posttest scores for TIB Bogor students

The results of statistical testing using the Shapiro-Wilk method show a p-value (0.0148), which is less than the specified significance level (0.05), meaning the null hypothesis (H0) is rejected. Namely, the normality assumption needs to be met for the data analyzed.
The Wilcoxon signed rank test analysis to see the difference in pretest and posttest scores showed that the median value was lower than the posttest. This matter indicates an improvement in the pretest condition after the intervention. In addition, the pretest scores' variability appears to be greater than on the posttest, as noted in the more comprehensive interquartile range (IQR) on the pretest. Most students showed an increase in their posttest scores from their pretest, especially individuals with relatively low initial pretest scores (50-80). However, some students showed a decrease in posttest scores compared to the pretest, especially individuals with relatively high initial pretest scores (above 80). Even though the posttest score fell, the decline was not too far from the pretest score.

This matter illustrates that lectures positively impact individuals with low initial pretest scores. In contrast, individuals with high initial pretest scores experience a decrease in posttest scores, although the decline is not too significant, as shown in Figure 2. Figure 2 supports the research results of [2] that the increase in knowledge between the pretest and posttest results before and after being given treatment with WhatsApp social media results in a p-value of 0.000, so it can be concluded that there is significant effectiveness of counselling via social media. WhatsApp towards increasing knowledge, attitudes and behaviour.

![Fig. 1a (left) Wilcoxon signed rank test and 1b (right) Shapiro Wild Statistics](image)

![Fig. 2. GG plots pre-test scores against post-test scores for Bogor students](image)
Significant differences between pretest and posttest scores were assessed using the Wilcoxon signed rank. The test results showed a p-value of 0.000504, much lower than the previously determined significance level (0.05), meaning that H0 was rejected, and the average posttest result of vocational students of IPB Bogor was higher than the pretest. This matter provides strong evidence that the lectures have positively impacted increasing the knowledge of IPB Bogor vocational students regarding plantation and forestry plant seed production techniques. These techniques are supported by the opinion of [2], namely that giving pretests and posttests can increase student motivation and interest in learning and readiness for learning activities to improve learning outcomes. Other factors influencing these differences must be considered in subsequent analysis, such as training methods, intervention time, or individual characteristics. This decrease is reasonable because maintaining high pretest scores is more complex than increasing low ones.

3.2 Pre-test and post-test scores for TIB Sukabumi students

The results of statistical testing using the Shapiro-Wilk method show a p-value (0.0741), which is more than the specified significance level (0.05), meaning that the null hypothesis (H0) is not rejected; that is, the assumption of normality is met for the data analyzed. A paired t-test will be used in the following analysis stage to see the difference in pretest and posttest exam scores.

![Shapiro-Wilk Statistics: 0.9476 P-value: 0.0741](image)

Some information can be obtained based on the results of the pretest and posttest comparison boxplots. First, the pretest boxplot shows that the median value is higher than the posttest. This matter shows a decrease in posttest scores after lectures. The variability of scores on the pretest looks lower compared to the posttest, which is indicated by the more comprehensive interquartile range (IQR) on the posttest. In contrast to TIB Bogor campus students, TIB Sukabumi campus students need to see a consistent pattern of increase or decrease in certain groups. Although no clear pattern exists, some students show unique ways in their pretest and posttest results. Interestingly, some students who got high scores on the pretest (around 70) got lower scores on the posttest, even below 50.

The p-value from the Wilcoxon signed rank test results is 0.9986, which is much higher than the previously determined significance level (0.05), meaning that it does not reject H0; that is, it cannot be proven that the average posttest score for IPB vocational students is Sukabumi was significantly higher than the pretest. These results need to provide stronger evidence that the lectures conducted positively impacted the knowledge of IPB Sukabumi vocational students regarding plantation and forestry plant seed production.
techniques. It should be noted that various factors, such as sample size, individual variations, or intervention methods, may influence results.

![GG plot of pre-test scores against post-test scores for Sukabumi students](image)

**Fig. 4.** GG plot of pre-test scores against post-test scores for Sukabumi students

The results of Magdalena’s research, 2021, are that because not every posttest is carried out, there is always an increase in students’ understanding because, after all, learning cannot be separated from what is called lecture obstacles and the lecturers have done and have their version of the best way to overcome these obstacles. Whatever the circumstances and obstacles, learning must continue and educational goals must still be achieved.

### 3.3 Comparison of Pretest and Posttest Scores for Vocational Students of IPB Bogor vs. Sukabumi

Based on the histogram results, the data distribution cannot be categorized as a distribution that is close to normal. This matter can be seen from the shape of the histogram, which tends to be skewness to the left for the Bogor pretest, Sukabumi pretest, and Bogor posttest) and the histogram shape, which tends to be uniform (for the Sukabumi posttest), shown in Figure 5.

![Histogram results](image)

**Fig. 5** Data distribution of pre-test and post-test scores and the boxplot of TIB Bogor and Sukabumi

Based on the boxplot results comparing the exam results of IPB Bogor and Sukabumi vocational students, it shows that the median score for the IPB Bogor student group is higher than that of Sukabumi. This case indicates a difference in the quality of IPB Bogor and
Sukabumi vocational students. The p-value for the pretest and posttest is 0, much lower than the previously determined significance level (0.05), meaning that H0 is rejected. Namely, the average score of the pretest and posttest exam results for IPB vocational students Bogor is higher than the vocational students of IPB Sukabumi.

These results indicate that the factors influencing the pretest and posttest scores between IPB Bogor and Sukabumi vocational students may differ. This difference could be caused by factors such as differences in educational background, quality of teaching, or student characteristics in the two locations, as research by [3] shows that learning outcomes are determined by several factors, both factors from within the learner and factors from outside the learner. Educate. One of the factors that determines student learning outcomes is the teaching and learning process in the classroom. Students work directly with real examples, apply their abilities, apply the principles and steps for problem-solving, and provide opportunities for student involvement in learning situations that are different from the learning process in the control class, where the learning process occurs in a classical teacher manner. Explaining learning material using discussion and question-and-answer methods so that students only receive explanations from the teacher; the teacher dominates learning activities in the class, so students tend to be inactive and only accept what the teacher conveys.

4 CONCLUSION

1. The level of knowledge of forestry plantation seed production at the start of the lecture (pretest), TIB Bogor campus students ranged from 37 to 99 with an average of 81, while the posttest scores ranged from 39 to 100 with an average of 91. The data shows a knowledge increase of ten based on the difference between the average pretest and protest scores. The level of knowledge of plantation and forestry plant seed production techniques at the start of lectures (pretest), TIB Sukabumi campus students ranged from 44 to 89, with an average of 77. In contrast, posttest scores ranged from 14 to 90, averaging 65. The data shows a knowledge increase of 12 based on the difference between the average pretest and protest scores.

2. Statistical tests show an increase in TIB Bogor students' knowledge during lectures based on the results of the pretest assessment compared with the posttest. Nearly 100% of the student's knowledge of seed production techniques for forestry plantation crops increased. In contrast to TIB Sukabumi students, based on statistical tests to compare pretest and post scores, it cannot be proven that the average posttest exam scores of IPB Sukabumi vocational students are significantly higher than their pretest. This matter shows that lectures on plantation and forestry plant seed production techniques have yet to provide strong evidence of increasing knowledge about this for TIB Sukabumi students. So, it is necessary to do further research related to the factors that influence the lecture process.

3. Statistical tests comparing the pretest and posttest scores of TIB Bogor and Sukabumi campus students show that the average score of IPB Bogor students is higher than that of Sukabumi. It is suspected that there are differences in factors that influence the achievement of this level of knowledge, such as differences in educational background, quality of teaching, or student characteristics in the two locations.
References