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Application of the E-module combined with the Guided Inquiry Learning Model to Increase Student Motivation and Learning Outcomes on the Structure and Function of Plant Tissues

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Abstract: The low learning motivation of students is a classic problem that often occurs in the teaching and learning process and has an impact on learning outcomes. One way that can be used by teachers in solving motivational problems and student learning outcomes is by applying innovative learning media such as e-modules combined with guided inquiry learning models. This study aims to determine differences in learning motivation, differences in increasing learning outcomes and the relationship between motivation and student learning outcomes through the application of e-modules combined with guided inquiry on the material structure and function of plant tissue. This research is quantitative with experimental research methods and research design Pre-test Post-test Control Group Design. The population in this study were 214 students from class XI IPA at SMAN 1 Darul Imarah and SMAN 1 Peukan Bada Aceh Besar. The research sample consisted of 121 students who were divided into two classes, namely the control class and the experimental class. The parameters of this study are the motivation and learning outcomes of students. The instrument for measuring motivation used 36 items of the ARCS motivational questionnaire, while learning outcomes were measured using 40 multiple choice tests. The increase in learning outcomes is calculated by the N-gain formula. Data analysis to see differences in motivation and differences in increasing learning outcomes used Mann Whitney test analysis, while analysis of the relationship between motivation and learning outcomes used Pearson's Product Moment correlation analysis. The results showed that there were differences in students' learning motivation ($p < 0.05$), there were significant differences in increasing learning outcomes ($p < 0.05$), there was a significant relationship between motivation and student learning outcomes. The conclusion of this study is that there are differences in motivation and differences in the increase in student learning outcomes after applying learning using e-modules combined with guided inquiry.

Key Word: E-module; Guided Inquiry; Learning Motivation; Learning Outcomes

Introduction

Motivation to learn is an encouragement both internal and external that comes from students to carry out a learning activity. The desire or encouragement and interest of students in learning is one of the keys to achieving success in learning. Students will study harder, be tenacious, diligent and have full concentration in the learning process if they have motivation in learning. Conversely, students who do not have motivation to learn will be indifferent, easily discouraged, not concentrating on learning, making it difficult to follow lessons in class (Palittin et al., 2019).

The encouragement of learning motivation is one of the things that needs to be raised in learning efforts at school, because learning motivation is very influential both directly and indirectly on student learning outcomes. Students who have high motivation in

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learning will be able to carry out learning activities with full responsibility and confidence when compared to students who have low learning motivation, so that the learning outcomes achieved can be obtained optimally.

Learning outcomes are changes that a person gets after going through a learning process, which includes changes in overall behavior. If someone learns something, as a result he or she will experience an overall change in behavior in attitudes, skills, knowledge and so on (Syamsu et al., 2019). The change in behavior referred to in this study is a situation in which students understand the subject matter that has been taught and are able to achieve competency standards and the minimum mastery criteria that have been applied.

Based on the results of observations made at SMAN 1 Peukan Bada and SMAN 1 Darul Imarah, information was obtained that students' learning motivation in biology subjects at both schools was still relatively low in biology subject matter. The low motivation to learn can be seen from the students who do not pay attention to the teacher when learning activities take place. Teachers still provide a lot of information in conveying material and students are not used to discovering their own knowledge. Students are less active in expressing abstract ideas and experiences in solving problems. Learning models combined with innovative media that can motivate students to be more interested in participating in the learning process have not been used by teachers. The learning resources used in the two schools also only use biology textbooks which cannot reach students to understand abstract material.

One of the biology subject matter in odd semesters that is considered difficult by students is the material on the structure and function of plant tissues. This material is considered difficult because in studying it students must have an overview of plant tissue whose study includes the structure and characteristics of the cells that make up plant tissues and organs that are microscopic in nature. Students are required to analyze the interrelationships between cell structures in plant tissues and organ functions in plants in basic competence (BC 3.3). Difficulty in understanding this material causes low learning motivation of students in learning activities so that it also has an impact on learning outcomes. This is supported by the findings of student learning outcomes obtained in the two schools with the average score in biology subject being below the minimum standard of completeness criteria set by the school (75).

Problems with learning motivation can be caused by students' low curiosity to learn because learning is not carried out contextually, there is no direct stimulation from the teacher through challenges with verbal questions, there is no equal opportunity to express ideas and learn new information. The availability of learning facilities is not good, there is no teacher effort with positive encouragement, the atmosphere is leading, creative and fun. The encouragement of positive verbal attitudes and inspiration from the teacher is the most crucial factor for increasing student learning motivation (Asrial et al., 2019).

The factors disclosed provide the conclusion that an innovative and non-monotonous learning model and media is urgently needed to facilitate understanding of the structure and function of plant tissue in order to increase student motivation and learning outcomes. One of the learning media that can be used to increase student motivation and learning outcomes is an electronic module (e-module). E-modules are teaching materials that are packaged digitally and can help teachers facilitate students in learning (Asrial et al., 2020).

Students can directly operate the e-module learning media which presents material with an interactive menu display. The term interactive means that e-modules can facilitate navigation, allow users to load images, audio, video and animation and are equipped with formative tests that ensure immediate automatic feedback (Baring & Berame, 2022). The use of this media is very easy for students and teachers to implement because it can be applied using electronic devices such as smartphones or Personal Computers (PC).

E-Module is a set of non-printed digital teaching media that is systematically arranged and used for independent learning activities, so that it can require students to learn to solve problems in their own way (Nurhasnah et al., 2020). E-modules can be used repeatedly, are easy to operate and can help students understand. Learning media that can be used repeatedly can help students repeat parts that have not been understood according to their abilities (Purwanto et al., 2020).

Ease of use of e-mdoul, attractive and interactive displays will provide comfort for students in learning so that it will significantly increase motivation and learning outcomes (Pramana et al., 2020). Learning using e-modules is seen as effective for improving learning outcomes because learning materials delivered using media are more effective than learning without using media. Students will be motivated to learn more independently and not depend too much on educators (Hariyani et al., 2021).

Apart from the media, effective learning strategies remain the most important factors for increasing learning motivation. Students' motivation can be stimulated by using attention-grabbing strategies, presenting the relevance of learning materials to their

needs, providing a stimulus for self-confidence to succeed and feeling satisfied with their performance results (Keller, 2010). An effective learning model equipped with the right computer technology can increase learning motivation. The e-module combined with the guided inquiry learning model is considered to be very effective for increasing student motivation and learning outcomes in abstract material such as the structure and function of plant tissues.

Guided inquiry refers to the constructivist paradigm, in which students actively construct their own knowledge. Through inquiry activities, students build their knowledge actively so that the desired learning outcomes can be achieved. Learners are involved in activities that are basically open, student-centered and directly based on real-life problems in inquiry learning activities. Several previous studies stated that students who were taught using the guided inquiry learning method had better achievement scores than students who were taught using conventional learning methods (Sudigdo & Perdana, 2020).

Guided inquiry-based e-modules provide new understanding for teachers to be able to improve analytical thinking skills through the integration of models such as guided inquiry learning into learning modules to meet the needs of students in the 21st century (Noris et al., 2023). Research related to the application of e-module assisted guided inquiry has been carried out in many studies both in the field of biology and in other fields of study (Sari et al., 2020; Noer et al., 2021; Syahmani et al., 2022; Miftakhurrohmah et al., 2023). However, research on the application of e-modules combined with guided inquiry in the field of biology studies, especially on the material structure and function of plant tissues, is still rarely carried out. Based on this, it is necessary to carry out further research on the application of e-modules combined with guided inquiry learning models on the material structure and function of tissues in plants with the hope of increasing student motivation and learning outcomes.

Method

This research was conducted at SMA Negeri 1 Peukan Bada and SMA Negeri 1 Darul Imarah, Aceh Besar District. The research method used in this research is experimental (experimental research) with a research design that is Control-Group Design with Random Assignment. The research design used in this study is a Pretest-Posttest Control Group Design.

The population in this study were students of class XI IPA at SMAN 1 Peukan Bada and SMAN 1 Darul Imarah in Aceh Besar with a total of 214 students from 7 classes. Sampling was carried out using a probability sampling technique, namely a sampling technique that provides equal opportunities for each member of the population to be selected as a sample. The type of probability sampling used for determining the sample in this study was random sampling which was carried out by giving a pretest to the entire population to obtain 2 (two) classes that had almost the same scores in each school. After the pretest was carried out, the sample was obtained as shown in table 1.

Table 1. Research Sample Control Class and Experiment Class

School	Classes			
	Experiment		Control	
	Classes	Sample	Classes	Sample
SMAN 1 Peukan Bada	XI IPA[2]	30	I IPA[3]	30
SMAN 1 Darul Imarah	XI IPA [3]	31	XI IPA[4]	30
Sum		61		60
Total				121

After obtaining four classes as samples, then they were randomly selected to serve as the experimental class and the control class. Learning in the control class was carried out using conventional methods, while in the experimental class learning was carried out using e-module media combined with the guided inquiry learning model.

The research data collection instruments used were test and non-test instruments. Objective test instruments are used to determine student learning outcomes through multiple choice tests given before and after learning in both the experimental class and the control class. While the non-test technique used aims to measure students' learning motivation by using a questionnaire containing 36 questions. Student learning motivation questionnaires are measured by four indicators namely attention, relevance, confidence, satisfaction which was developed by (Huang & Hew, 2016) from John Keller (1983).

Data analysis of learning motivation was carried out on data obtained from questionnaire answers given to students after learning, while analysis of learning achievement data was carried out on initial ability data (pretest scores) and final ability data (posttest scores) on student learning outcomes. Prior to data analysis, tabulation was first performed. Tabulation is the compilation of data in tabular form and is carried out on motivational data and pre-test and post-test data on student learning outcomes. To find out the increase in measured learning outcomes, the calculation of the normalized average gain (N-gain) score data developed by Meltzer (2002) is used.

After calculating the average score of students' motivation and learning outcomes, an analysis of the average difference test was carried out. Before the mean difference test is carried out, the motivational data and student learning outcomes are first tested for normality and homogeneity. The data on motivation and learning outcomes obtained in this study after the normality and homogeneity tests were carried out, it was found that one of the data in the experimental and control classes was not normally distributed and the control class and experimental class data had non-homogeneous variances. Test the difference in the average motivation and n-gain learning outcomes of the experimental and control classes was carried out using a non-parametric statistical test, namely the Mann Whitney Test with the help of the SPSS program. 22 for windows with the provision of hypothesis testing if Sig. < 0.05 then it is stated to be significantly different between the two tested means, whereas if Sig. ≥ 0.05 then there is no significant difference between the two averages tested.

Analysis of the relationship between motivation and learning outcomes was carried out using Pearson product moment correlation calculations. The decision of the correlation test is seen based on the t test. The decision is accepted if t-count ≥ t-table at a significant level of 0.05, then there is a significant relationship between learning motivation and learning outcomes.

Result and Discussion

Motivation to learn

After analyzing the average score of students' learning motivation, it can be seen that the experimental class obtained a higher average score than the control class. The mean score of students' learning motivation in the experimental group was 76.10 while in the control group it was only 60.11. The average score of learning motivation in the control and experimental classes can be seen in Figure 1.

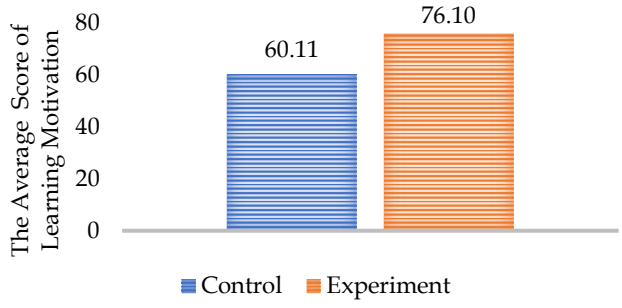

Figure 1. Average Score of Control Class Learning Motivation and Experiment Class

Data on the average score for each ARCS indicator of learning motivation of students in the control class and experimental class are presented in Figure 2.

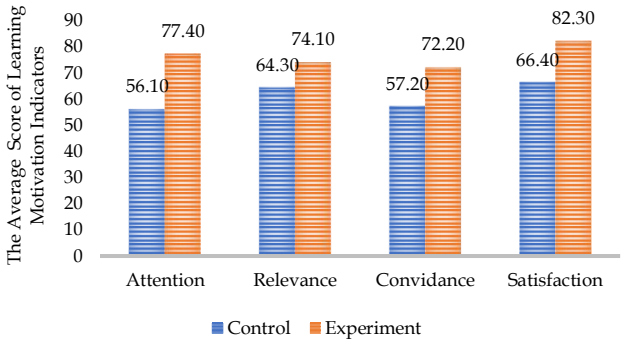

Figure 2. Mean Score of ARCS Motivation Indicator for Control and Experiment Classes

Based on the results shown in Figure 2, it can be seen that e-module learning combined with guided inquiry has the highest effect on satisfaction indicators. Students who are taught with the e-module combined with guided inquiry look more satisfied and happier during the learning process than the control class. This is evident from the mean satisfaction indicator score in the experimental class of 82.30 in the good category, while in the control class it was only 66.40 in the sufficient category.

E-module provides its own learning satisfaction for students. Students who use e-modules find it easier to find material concepts compared to those who do not use e-modules. This is because the e-module is equipped with material, practice questions which contain key questions to help students find a concept independently so that learning outcomes also increase. The exercises are integrated into the E-module and notifications related to student achievement will appear when doing the exercises, so that students can know directly how far they understand the material they have learned, which will support their independent learning (Nurhasnah et. al., 2020).

The lowest aspect mean score in the experimental class was shown in the confidence aspect with an average score of only 72.20 in the sufficient category, while the control class was 57.20 in the sufficient category. Confidence motivational indicators based on observations seen from students' self-confidence and optimism. The confidence indicator in the experimental class is higher than the control. Based on the results of observations during the learning process students' self-confidence appeared when they asked questions, argued and was seen in presentation activities. Students in the experimental class had high enthusiasm, confidently advancing for presentations without being appointed by the teacher. In addition, when working on the evaluation

questions the students looked orderly and worked on the questions independently, whereas in the control class at the time of the presentation the students still looked less confident and felt embarrassed because they were not used to expressing their opinions in front of the class.

Guided inquiry is constructive, requiring students to ask questions, put forward hypotheses and argue that it can grow students' self-confidence. According to Hamzah et al. (2020) students' self-confidence in learning can be increased by using problem-based learning methods and contextual learning. In addition, it is also known that aspects of confidence can increase because students in the experimental class before conducting learning in their classrooms have already done independent learning using e-modules that are easily accessible anywhere and anytime.

The use of e-modules that are practical and easy to use whenever and wherever it is known can provide initial knowledge for students before entering the classroom. According to Panggabean & Tamba (2020) Initial knowledge is something that needs attention to identify new knowledge that will be received, because learning must be built on a solid foundation of initial knowledge so that it is able to build learning. The knowledge gained by students through self-study using e-modules means that students' knowledge does not only come from the teacher but can be obtained through materials and assignments carried out in e-modules. The experience gained makes students more confident in doing assignments and facing the learning process in class (Effendi et al., 2018). The results of the average different test to see differences in learning motivation in the control class and the experimental class can be seen in Table 2.

Table 2. Two Difference Test Average Learning Motivation

Score	N	Ave-rage	Normality test*)	Homogenity test **)	Mann Whitney test***)
Experiment	61	76.10	Sig (0.200)	Sig (0.00)	Sig (0.00)
Control	60	70.11	Sig (0.000)		

Note:
*) = *Kolmogorov Smirnov Test* (Normal, Sig > α 0,05)
**) = *Levene Test* (Homogentiy, Sig > α 0.05)
***) = *Uji Mann Whitney* (Ha accepted Sig < α 0.05)

Based on table 2 above, it shows that the Mann Witney test results were obtained by Sig. 0.000 <0.05, which means that the learning motivation of the control class and experimental class students is significantly different. This means that there is a significant difference in motivation between the control group and the experimental group in the structure and function of plant tissue. The application of e-module media combined with guided inquiry shows better learning motivation compared to students who are taught using conventional methods. Guided inquiry-based e-modules along with practical and interesting visual labrotium are used so as to provide enthusiasm and attract students' learning interest (Ravista et al., 2021).

Learning outcomes

The learning outcomes of students in this study included pre-test and post-test. The results of the pre-test and post-test results of the control class and the experimental class were seen by the difference using the N-gain formula. The difference in the average pre-test, post-test and N-gain of students in the control class and the experimental class can be seen in Figure 3.

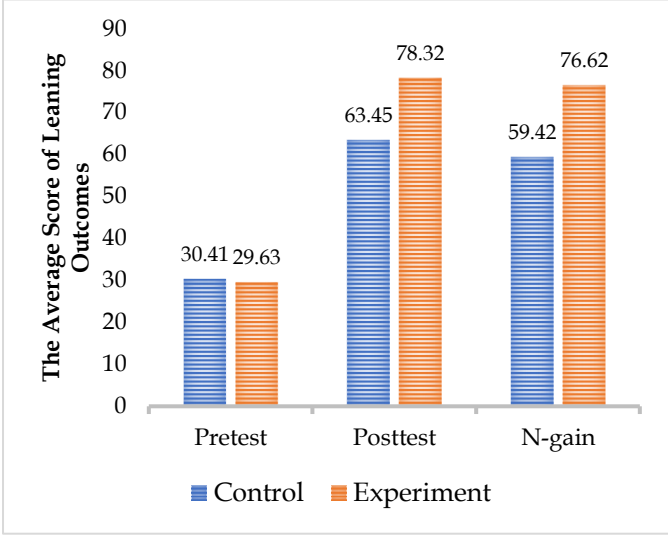

Figure 3. The mean pre-test, post-test and N-gain scores for the control group and the experimental group

Based on Figure 3, it shows that the overall mean pre-test score of the control class students was 30.41 while the experimental class was 29.63, which means that the pre-test scores in the two classes did not show a significant difference. These results also indicate that the initial ability of students in mastering the structure and function of plant tissue prior to implementing the e-module combined with guided quiry has the same level of ability between the experimental class and the control class.

After the students were given treatment with the application of the e-module combined with guided inquiry in the experimental group and the control group which applied conventional learning, the ability of students' understanding of the material structure and function of plant tissue increased. This is shown by the average post-test and N-gain score data. The mean N-gain gain for the experimental class was 76.62 which was

classified as high, while the control class was only 59.42 in the medium category. The use of e-modules can make it easier for students to understand material on the structure and function of plant tissues compared to conventional learning which only uses textbooks. The increase in student learning outcomes is known because the application of e-modules combined with guided inquiry creates learning that is more meaningful and relevant to students.

The inquiry model means a series of learning activities that maximally involve all students' abilities to search and investigate systematically, critically, logically, and analytically so that students can formulate their own findings with confidence. The guided inquiry learning model allows students to freely develop the concepts they find and learn so that it is not just material that is just rewritten and then memorized, but students are given the opportunity to exchange ideas in solving the problems they face. Thus, this model fosters students' scientific attitudes and science process skills, and learning lasts longer because students are directly involved in the learning process and knowledge becomes long-lasting and easy to remember (Arifuddin et al., 2020).

The e-module presents material, pictures and learning videos regarding the structure and function of plant tissues which are considered abstract. The e-module is used to assist in facilitating students in guided inquiry activities which include identifying problems, formulating problems, formulating hypotheses, collecting data, verifying results and generalizing conclusions gradually. Students learn actively, learn based on what they know, develop their way of thinking through guidance from the teacher. Through guided inquiry, the development of students' knowledge occurs gradually, they will have different ways of learning and also learn by means of social interaction with others (Kholida et al., 2020). So, with the existence of e-modules and through inquiry activities students do not only make the teacher the only source of learning and students avoid traditional learning methods (memorization).

The emergence of an increase in learning outcomes in the experimental class was also due to the fact that students were required to study with the e-module before being at home or anywhere using a smartphone. There are many advantages to learning by using e-learning, including flexibility, saving time, simple and easy access to material that has been studied. E-learning is useful for collecting and recording data, communicating, and sharing student learning experiences with teachers and students can publish and present their knowledge (Gerasimova et al., 2018). Through e-learning, learning can be done anytime and anywhere, not bound by space so that students before entering the class already have prior knowledge and the learning process in class can maximize the time to discuss with group mates. The results of the statistical test analysis of increasing learning outcomes in the experimental class and control class can be seen in Table 3.

Table 3. N-gain Mean Difference Test in Learning Outcomes of Experiment Class and Control Class Students

Score	N	Average	Uji Normality test*)	Homogenity test**)	Mann Whitney test***)
Experiment	61	76.62	Sig (0.200)	Sig (0.001)	Sig (0.000)
Control	60	59.42	Sig (0.200)		

Note:
*) = *Kolmogorov Smirnov Test* (Normal, Sig > α 0.05)
**) = *Levene Test* (Homogenity, Sig > α 0.05)
***) = Uji *Mann Whitney* (Ha accepted, Sig < α 0.05)

Table 3 shows the results of the Mann Whitney test obtained by Sig. 0.000 <0.05, meaning that there is a significant difference in increasing the learning outcomes of students in the control class and the experimental class. The difference in the mean N-gain score in the experimental class shows a higher increase in learning outcomes than the increase in learning outcomes in the control class. Based on these results, it is believed that the e-module combined with guided inquiry has a positive effect on increasing student learning outcomes in mastering the structure and function of plant tissue. The results of this study are in line with research by Miftakhurrahmah et al., (2023) there is a difference in average scores between before being given learning using guided inquiry-based e-modules and after using guided inquiry-based e-modules on human excretion material. In accordance with Sari et al. (2020) which stated that guided inquiry-based e-modules can improve cognitive learning outcomes in respiratory system material.

Correlation of Motivation with Learning Outcomes

Learning motivation is one of the internal factors that influence student learning outcomes. To prove this relationship, a correlation test was carried out. The recapitulation of the results of the correlation test between motivation and learning outcomes can be seen in Table 4.

Based on Table 4. it can be seen that the results of the correlation test between learning motivation and learning outcomes obtained a correlation coefficient (r) of 0.81. This shows that the motivation and learning

outcomes of students have a positive correlation with a very strong interpretation. Learning motivation has a strong contribution to learning outcomes. These results are in line with research by Budiariawan (2019) which states that there is a positive correlation between learning motivation and student learning outcomes.

Table 4. Correlation Analysis between Motivation and Learning Outcomes

Groups	Motivation (X)	Learning Outcomes (Y)	Sig	Corelation (r)	Determi n-ing coefficient (R^2)
Score Average	76.10	78.32	0.000	0.81	0.66

Based on Table 4, the coefficient of determination (R2) obtained is 0.66. The coefficient of determination (R2) obtained means that students' learning motivation after learning using e-modules combined with the guided inquiry learning model has an effect of 66% on their learning outcomes, while 44% is influenced by other factors not examined in this study. These results provide evidence that individuals who do not have motivation to learn will not be able to carry out learning activities and their learning outcomes will decrease. Conversely, someone who has motivation to learn will carry out learning activities well and have better learning outcomes. Statistical test of the correlation between motivation and student learning outcomes is shown in Table 5.

Table 5. Correlation Test of Learning Motivation and Learning Outcomes

Groups	Learning Motivation (X)	Learning Outcomes (Y)	t-test	Information
Score Average	76.10	78.32	15.39 > 1.98 t-count > t-table	Significant

Based on Table 5, it shows that the results of the statistical correlation test between motivation (variable X) and learning outcomes (variable Y) are obtained t-count > t-table, namely 15.39 > 1.98 at the Sig level. α = 0.05. This shows that between motivation and learning outcomes there is a significant correlation. The description of the regression between motivation and student learning outcomes is shown in Figure 4.

Figure 4. explains the direction of the regression between the two variables. This equation is in accordance with the data obtained so that a radiating diagram is formed. The transmitter forms a straight line with the equation y = 12.939+0.851x, which means that the higher the learning motivation, the higher the learning outcomes.

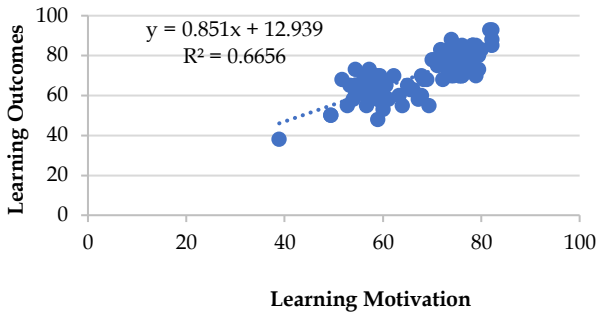

Figure 4. Regression between Learning Motivation and Learning Outcomes

Motivation to learn is the driving force from within the learner which gives rise to learning activities. Learning motivation is important to be owned by an individual in his learning activities. Motivation will provide and foster students' enthusiasm for learning, enthusiasm for learning various things, especially biology lessons because motivation is one of the internal factors that influence learning outcomes. The basic components of motivation include several aspects including needs, behavior and goals. These three aspects need to be owned by each individual, in this case a student in the process of achieving the desired goal, namely high learning outcomes (Saputra et al., 2018).

Learning motivation is strongly influenced by students' intrinsic and extrinsic factors such as place of study, intelligence, facilities and infrastructure, time, study habits, parents, emotions and health, and friend factors. In general, digital integrated learning methods can improve student learning outcomes and motivation (Peng & Fu, 2021). The e-module combined with guided inquiry is known to be able to provide encouragement to students' learning motivation. Based on observations, students are more likely to be excited when given a push from outside, this is the cause of higher motivation compared to other factors. Motivation to learn is very important to develop because it can affect cognitive aspects, psychomotor aspects, and other affective aspects. Learning motivation can stimulate students to study optimally and is reflected in increased learning outcomes (Harefa & Silalahi, 2020).

Conclusion

There are differences in motivation between the experimental class and the control class, there are differences in increasing learning outcomes between the control class and the experimental class and there is a significant relationship between learning motivation and

student learning outcomes in the material structure and function of plant tissue.

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Author Contributions
Conceptualization: Arina Dini, data curation: Hafnati Rahmatan, Muhibbuddin, funding acquisition: Arina Dini, methodology: Arina Dini, Hafnati Rahmatan, Muhibbuddin, writing original draft: Arina Dini, writing review: Hafnati Rahmatan, Muhibbuddin, Cut Nurmaliah, Safrida, editing: Arina Dini

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