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Enhancing Students' Self-Confidence through the Mordiscvein Learning Model in Plant Tissue Structure and Function Learning

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Abstract
Students' self-confidence is a crucial affective factor in science learning because it influences their willingness to express ideas, make decisions, participate in discussions, and communicate scientific reasoning. However, preliminary observations in biology learning indicated that students' self-confidence in the topic of plant tissue structure and function remained low, particularly in relation to belief in their own ability, independence in decision-making, positive self-concept, persistence, and courage to express opinions. This study aimed to examine the effect of the Mordiscvein learning model on students' self-confidence in learning plant tissue structure and function. A quantitative approach with a quasi-experimental design was employed using a nonequivalent control group design. The participants were 66 eleventh-grade students at SMA Perintis 2 Bandar Lampung, consisting of 34 students in the experimental class taught using the Mordiscvein learning model and 32 students in the control class taught using Discovery Learning. Data were collected using a structured self-confidence questionnaire and analyzed through descriptive statistics, normality and homogeneity tests, an independent sample t-test, and effect size analysis. The results showed that the experimental class achieved a higher mean posttest score (86.50%) and N-Gain score (61.10%) than the control class, which obtained a mean posttest score of 67.25% and an N-Gain score of 39.44%. The independent sample t-test indicated a significant difference between the two groups, with t = 3.561, df = 52.418, and Sig. (2-tailed) = 0.001. The Cohen's d value of 0.86 further indicated a large effect size. These findings demonstrate that the Mordiscvein learning model significantly improves students' self-confidence in biology learning. The structured stages of Mordiscvein, including Opening Surprise, hypothesis construction, data publication, fact determination, and conclusion building, provide students with repeated opportunities to communicate, make decisions, collaborate, and express scientific ideas confidently. This study implies that Mordiscvein can be used as an alternative student-centered learning model to strengthen affective engagement and self-confidence in science education.
Keywords: Biology Learning; Mordiscvein Learning Model; Plant Tissue; Science Education; Self-Confidence.

INTRODUCTION

Science education in the twenty-first century is increasingly expected to prepare students not only to master scientific concepts but also to participate actively in inquiry, argumentation, decision-making, and evidence-based communication (An Nuril Maulida Fauziah et al., 2024; Darmaji et al., 2022; Mesci et al., 2025; Rohayati et al., 2022). Contemporary science learning emphasizes students' ability to investigate phenomena, evaluate information, construct explanations, and communicate scientific ideas in meaningful contexts (Handoko et al., 2024; Laliyo et al., 2023; Moore & Wright, 2023; Seeratan et al., 2020). The National Research Council's framework for science education highlights that science learning should engage students in core disciplinary ideas, crosscutting concepts, and scientific practices such as using evidence, developing explanations, and argumentation (Kaldaras et al., 2021; National Research Council, 2012; Nelson et al., 2023). Similarly, the OECD's PISA 2022 creative thinking framework indicates that students need opportunities to generate, evaluate, and improve ideas in scientific problem-solving contexts, showing that science education must move beyond content transmission toward active intellectual and affective engagement (OECD, 2023, 2024).

Within this broader agenda, self-confidence has become an important affective dimension in science learning (Haka et al., 2025; Rahmawati et al., 2024; Setiawan et al., 2023). Students

who possess strong self-confidence tend to be more willing to express opinions, ask questions, make decisions, participate in group discussions, and present their scientific reasoning (Muqopi & Afriansyah, 2025; Setiawan et al., 2023; Suryanda et al., 2022). In contrast, students with low self-confidence often hesitate to speak, avoid academic risks, depend excessively on teacher confirmation, and become passive during learning activities (Suryanda et al., 2022; Tia & Wangid, 2024). In science classrooms, this issue is particularly important because learning science requires students to observe, hypothesize, interpret data, defend explanations, and communicate conclusions (Duschl et al., 2021; Pols et al., 2021; Yustika et al., 2023). Studies on science and biology education have shown that self-confidence and related constructs such as science self-efficacy and self-concept are associated with students' motivation, cognitive engagement, and learning outcomes (Miharja et al., 2024; Rahmawati et al., 2024; Shamdas, 2023).

The issue of self-confidence is highly relevant in biology learning, especially in the topic of plant tissue structure and function. This topic requires students to understand abstract and microscopic biological structures, connect tissue characteristics with physiological functions, interpret visual representations, and explain the relationship between plant organs and their supporting tissues. Learning this topic cannot rely solely on memorization because students need to observe, classify, compare, analyze, and communicate biological ideas (Rahmadani & Rudyatmi, 2025; Saidil Mursali, Ika Nurani Dewi, 2025; Septiana et al., 2022). However, in many classrooms, plant tissue learning is still dominated by teacher explanation, textbook reading, and concept memorization (Reality & Learning, 2026; Sari & Subali, 2021). Such learning conditions may limit students' opportunities to express opinions, formulate questions, conduct inquiry, and present their understanding (Fatmawati et al., 2025; Maryani et al., 2021). As a result, students may understand biological terms superficially but remain hesitant to communicate scientific explanations independently.

The field problem identified in this study strengthens the urgency of developing a more active and confidence-building learning model. Preliminary data from the research site showed that students' self-confidence in biology learning was still in the low category. The average initial self-confidence score reached only 33.15%, indicating that many students were not yet confident in their own abilities, were hesitant to make learning decisions, had not developed a sufficiently positive self-concept, and were reluctant to express opinions during classroom interaction. The original study also reported that students were still hesitant to express ideas and make decisions in the learning process, while the research design compared a class taught using the Mordiscvein learning model with a class taught using Discovery Learning. This condition indicates that the problem is not merely cognitive but also affective and pedagogical: students require a learning environment that provides repeated opportunities to speak, decide, investigate, collaborate, and receive constructive feedback.

Previous studies have attempted to improve students' self-confidence through various active learning models. Problem-Based Learning, Discovery Learning, inquiry-based learning, collaborative learning, and technology-supported learning have been reported to improve students' confidence, self-efficacy, communication, and engagement because these approaches require students to solve problems, discuss ideas, and construct knowledge through active participation (Li, 2025; Muhammad Ilyas et al., 2025; Yanuarto et al., 2024). Recent biology education research also shows that instructional models integrating active learning, contextual problems, and reflective activities can strengthen students' self-confidence and scientific literacy (Haka et al., 2025). These findings suggest that students' affective development is closely related to the learning structure created by teachers. When students are positioned as active learners rather than passive recipients of information, they are more likely to develop confidence in participating in scientific discourse.

Nevertheless, the state of the art shows that the Mordiscvein learning model has not been sufficiently examined in relation to students' self-confidence in secondary biology learning. Mordiscvein is a relatively new learning model developed from the integration of inquiry and discovery learning principles (Oktafiani et al., 2025; Saleh et al., 2022, 2023). It consists of

structured stages such as Opening Surprise, Ice Breaking for problem formulation and hypothesis construction, formulating experimental steps, data publication, determining facts through active responses, and arranging keywords into conclusions (Oktafiani et al., 2025). Previous studies have reported that Mordiscvein can improve learning outcomes, motivation, creativity, and critical thinking, particularly in science learning and elementary school contexts (Oktafiani et al., 2025; Saleh et al., 2022, 2023).

The research gap lies in three main aspects. First, most existing studies on Mordiscvein focus on cognitive outcomes such as learning achievement and critical thinking, while its influence on affective outcomes, especially self-confidence, remains underexplored. Second, previous studies have mainly examined Mordiscvein in elementary science learning, whereas its application in senior high school biology learning is still limited. Third, there is a lack of research that specifically investigates Mordiscvein in the context of plant tissue structure and function, a biology topic that requires not only conceptual understanding but also confidence in observation, explanation, decision-making, and scientific communication. Therefore, the novelty of this study lies in positioning Mordiscvein as a student-centered pedagogical intervention to strengthen students' self-confidence in secondary biology learning, specifically in the topic of plant tissue structure and function.

As a proposed solution, the Mordiscvein learning model is considered relevant because its syntax provides systematic opportunities for students to become actively involved in the learning process. The Opening Surprise stage can stimulate curiosity and reduce students' initial anxiety toward the topic. The problem-formulation and hypothesis stages encourage students to express ideas and make initial decisions. The experiment-planning and data-publication stages require students to collaborate, negotiate meaning, and communicate findings. The fact-determination stage trains students to justify their responses, while the conclusion-building stage supports students in organizing scientific ideas into coherent explanations. These learning experiences are expected to strengthen students' belief in their abilities, independence in decision-making, positive self-concept, and courage to express opinions.

Based on the above background, this study is guided by the following research question: Does the Mordiscvein learning model significantly affect students' self-confidence in learning plant tissue structure and function? Accordingly, this study aims to examine the effect of the Mordiscvein learning model on students' self-confidence in biology learning, particularly on the topic of plant tissue structure and function. The findings are expected to contribute to science education by providing empirical evidence on the use of Mordiscvein as an alternative student-centered model for developing affective engagement in biology classrooms.

METHODS

This study employed a quantitative approach using a quasi-experimental design. The quasi-experimental method was selected because the research was conducted in an authentic classroom setting where the researcher could not randomly assign individual students into experimental and control groups (Ballance, 2024; Capili & Anastasi, 2024). Instead, intact classes were used to examine the effect of the Mordiscvein learning model on students' self-confidence in learning plant tissue structure and function. This design was appropriate because it allowed the researcher to compare students' self-confidence before and after treatment in two different instructional conditions.

The study used a nonequivalent control group design involving one experimental class and one control class. The experimental class was taught using the Mordiscvein learning model, while the control class was taught using Discovery Learning. Both groups were given a self-confidence questionnaire before and after the learning intervention. The research design is presented in Table 1.

Table 1. Nonequivalent Control Group Design Used in the Study

Group	Pretest	Treatment	Posttest
Experimental class	Self-confidence questionnaire	Biology learning using the Mordiscvein learning model	Self-confidence questionnaire
Control class	Self-confidence questionnaire	Biology learning using Discovery Learning	Self-confidence questionnaire

The participants of this study were eleventh-grade students at SMA Perintis 2 Bandar Lampung, Indonesia. The research was conducted in biology learning on the topic of plant tissue structure and function. Two intact classes were involved in this study. One class was assigned as the experimental group and received instruction using the Mordiscvein learning model, while the other class served as the control group and received instruction using Discovery Learning. The selection of both classes was based on the similarity of grade level, curriculum exposure, and biology learning schedule. The learning topic was selected because plant tissue structure and function requires students to identify biological structures, connect tissue characteristics with their functions, analyze visual and contextual information, and communicate scientific explanations during classroom activities. The participants and instructional conditions are summarized in Table 2.

Table 2. Participants and Instructional Conditions

Group	Class	Grade Level	Learning Topic	Learning Model	Number of Students
Experimental class	XI IPA 1	XI	Plant tissue structure and function	Mordiscvein learning model	34
Control class	XI IPA 2	XI	Plant tissue structure and function	Discovery Learning	32
			Total		**66**

The independent variable in this study was the learning model, consisting of the Mordiscvein learning model in the experimental class and Discovery Learning in the control class. The dependent variable was students' self-confidence in biology learning. Although the original research examined both critical thinking and self-confidence, this article focuses specifically on self-confidence to provide a more focused contribution to science education research. The operational definitions of the research variables are presented in Table 3.

Table 3. Research Variables and Operational Definitions

Variable	Type	Operational Definition	Indicators
Mordiscvein learning model	Independent variable	A student-centered learning model integrating inquiry and discovery-oriented activities through structured learning stages, including Opening Surprise, problem formulation, hypothesis construction, experimental planning, data publication, fact determination, and conclusion building.	Implementation of Mordiscvein syntax in biology learning
Self-confidence	Dependent variable	Students' belief in their ability to participate, communicate, make decisions, and express opinions during biology learning on plant tissue structure and function.	Belief in one's own ability; independence in decision-making; positive self-concept and persistence; courage to express opinions

The learning intervention in the experimental class was implemented using the syntax of the Mordiscvein learning model. The model integrates inquiry and discovery learning principles and places students at the center of the learning process. The instructional stages included Opening Surprise, problem formulation and hypothesis construction through ice-breaking activities, formulation of experimental steps, data publication, fact determination, and construction of conclusions. These stages were designed to provide repeated opportunities for

students to express ideas, make decisions, collaborate, communicate findings, and build confidence in biology learning. The syntax of the Mordiscvein learning model implemented in the experimental class is presented in Table 4.

Table 4. Syntax of the Mordiscvein Learning Model in Plant Tissue Learning

Stage	Learning Activity	Expected Contribution to Self-Confidence
Opening Surprise	Students were stimulated with prompts, pictures, questions, or key terms related to plant tissue structure and function.	Encouraging curiosity and reducing initial anxiety toward the learning topic.
Problem formulation and hypothesis construction	Students discussed biological problems and proposed tentative explanations related to plant tissues.	Training students to express ideas and build confidence in their own reasoning.
Formulating experimental or investigation steps	Students collaboratively determined learning or investigation steps to explore plant tissue concepts.	Strengthening independence in decision-making and collaborative responsibility.
Data publication	Students presented discussion results, observations, or findings in front of the class.	Developing courage to communicate and present scientific ideas.
Fact determination	Students distinguished factual and inaccurate statements related to plant tissue structure and function.	Building confidence in evaluating information and defending answers.
Constructing conclusions	Students arranged key concepts into conclusions based on the learning process.	Strengthening positive self-concept through successful knowledge construction.

In the Opening Surprise stage, students were given visual or verbal prompts related to plant tissue structure and function to stimulate curiosity and activate prior knowledge. During the problem formulation and hypothesis construction stage, students worked in groups to identify biological problems and propose tentative explanations. In the investigation stage, students collaboratively formulated learning steps, explored information, analyzed learning materials, and discussed plant tissue concepts. In the data publication stage, students communicated their findings to the class. In the fact-determination stage, students evaluated statements and decided whether they represented factual information. Finally, students constructed conclusions by organizing important concepts obtained during the learning process.

The control class was taught using Discovery Learning. The learning process in this class followed common discovery stages, including stimulation, problem identification, data collection, data processing, verification, and conclusion drawing. Discovery Learning was selected as the comparison model because it also represents an active learning approach commonly used in science classrooms. However, the control learning process did not include several distinctive features of Mordiscvein, such as Opening Surprise, ice-breaking-based hypothesis presentation, interactive data publication, and fact determination through active student responses. The comparison between the instructional conditions in the experimental and control classes is presented in Table 5.

Table 5. Comparison of Learning Activities in Experimental and Control Classes

Aspect	Experimental Class	Control Class
Learning model	Mordiscvein learning model	Discovery Learning
Learning orientation	Student-centered, inquiry-discovery-based, interactive, and confidence-building	Student-centered discovery-based learning
Initial activity	Opening Surprise using prompts related to plant tissues	Stimulation related to the learning topic
Problem activity	Problem formulation and hypothesis construction through interactive discussion	Problem identification
Investigation activity	Collaborative formulation of investigation steps and exploration of plant tissue concepts	Data collection and data processing
Communication activity	Data publication through student presentation and peer response	Verification and discussion
Evaluation of	Fact determination through active student	Verification of findings

information	responses	
Closing activity	Arranging keywords into conclusions	Drawing conclusions

The research instrument was a structured self-confidence questionnaire developed in relation to the topic of plant tissue structure and function. The questionnaire consisted of 20 statements representing four indicators of self-confidence: belief in one's own ability, independence in decision-making, positive self-concept and persistence, and courage to express opinions. These indicators were considered relevant to biology learning because students are required to express ideas, make decisions, engage in discussions, explain concepts, and present their understanding of biological phenomena. The indicators of the self-confidence questionnaire are presented in Table 6.

Table 6. Indicators of the Self-Confidence Questionnaire

Indicator	Description	Item Numbers
Belief in one's own ability	Students' confidence in understanding plant tissue concepts and expressing their ideas during biology learning.	1, 2, 11, 12
Independence in decision-making	Students' ability to make decisions when answering questions or selecting learning strategies related to plant tissue learning.	3, 4, 13, 14
Positive self-concept and persistence	Students' tendency to remain motivated, optimistic, and persistent when facing difficulties in understanding plant tissue structure and function.	5, 6, 15, 16
Courage to express opinions	Students' confidence in speaking, presenting, asking questions, explaining concepts, and participating in classroom or practical activities.	7, 8, 9, 10, 17, 18, 19, 20

The questionnaire included both favorable and unfavorable statements to reduce response bias and obtain a balanced measurement of students' self-confidence. Favorable statements reflected confidence, persistence, comfort in speaking, and courage to present scientific ideas. Unfavorable statements reflected hesitation, anxiety, indecision, fear of making mistakes, and reluctance to communicate during learning. The distribution of favorable and unfavorable items is shown in Table 7.

Table 7. Distribution of Favorable and Unfavorable Statements

Item Type	Item Numbers	Statement Orientation
Favorable statements	1, 2, 3, 4, 5, 6, 7, 8, 9, 10	Statements indicating the presence of self-confidence
Unfavorable statements	11, 12, 13, 14, 15, 16, 17, 18, 19, 20	Statements indicating hesitation, anxiety, or lack of self-confidence

The questionnaire used a Likert scale. For favorable statements, higher scores indicated stronger self-confidence, whereas for unfavorable statements, the scoring was reversed. The scoring scheme is presented in Table 8.

Table 8. Scoring Scheme of the Self-Confidence Questionnaire

Statement Type	Strongly Agree	Agree	Disagree	Strongly Disagree
Favorable statements	4	3	2	1
Unfavorable statements	1	2	3	4

Before being used in the main study, the questionnaire was reviewed to ensure that all items were aligned with the indicators of self-confidence and the context of plant tissue learning. The instrument was also examined for validity and reliability to ensure that it was appropriate for measuring students' self-confidence consistently. The validation process focused on the relevance of the items to the indicators, clarity of language, suitability for students' cognitive level, and contextual relevance to biology learning. Reliability testing was

conducted to examine the internal consistency of the questionnaire.

Data were collected through pretest and posttest administration of the self-confidence questionnaire. The pretest was administered before the learning intervention to identify the initial level of students' self-confidence in both groups. The posttest was administered after the intervention to determine changes in students' self-confidence after participating in the learning process. The use of pretest and posttest data enabled comparison of students' self-confidence before and after treatment and allowed the researcher to identify differences between the experimental and control groups. The data collection techniques and instruments are summarized in Table 9.

Table 9. Data Collection Techniques and Instruments

Data Type	Instrument	Purpose	Time of Administration
Self-confidence data	Structured self-confidence questionnaire	To measure students' self-confidence before and after the treatment	Pretest and posttest
Instructional implementation data	Lesson plans and learning activity documentation	To ensure the implementation of Mordiscvein and Discovery Learning during the intervention	During treatment

The research procedure consisted of several stages. First, the researcher conducted a preliminary study to identify classroom problems related to students' low self-confidence in biology learning. Second, the researcher prepared learning materials, lesson plans, and the self-confidence questionnaire based on the topic of plant tissue structure and function. Third, the pretest questionnaire was administered to both the experimental and control classes. Fourth, the learning intervention was implemented: the experimental class was taught using the Mordiscvein learning model, while the control class was taught using Discovery Learning. Fifth, the posttest questionnaire was administered to both groups after the intervention. Finally, the collected data were analyzed to determine the effect of the Mordiscvein learning model on students' self-confidence. The research procedure is summarized in Table 10.

Table 10. Research Procedure

Stage	Description
Preliminary study	Identifying classroom problems related to students' low self-confidence in biology learning.
Instrument preparation	Developing and reviewing the self-confidence questionnaire based on indicators and plant tissue learning context.
Pretest	Administering the self-confidence questionnaire to both groups before treatment.
Treatment	Implementing Mordiscvein in the experimental class and Discovery Learning in the control class.
Posttest	Administering the self-confidence questionnaire to both groups after treatment.
Data analysis	Analyzing the collected data using descriptive and inferential statistics.

The data were analyzed quantitatively using descriptive and inferential statistics. Descriptive statistics were used to calculate the mean, percentage, and category of students' self-confidence scores. Before hypothesis testing, normality and homogeneity tests were conducted to ensure that the assumptions for parametric analysis were fulfilled. If the data were normally distributed and homogeneous, an independent sample t-test was used to determine whether there was a significant difference in self-confidence between the experimental and control classes after the treatment. The significance level was set at 0.05. To strengthen the interpretation of the findings, effect size analysis using Cohen's d may also be included to determine the practical magnitude of the difference between the two learning groups. The data analysis procedures are presented in Table 11.

Table 11. Data Analysis Procedures

Stage	Analysis Technique	Purpose
1	Descriptive statistics	To describe the mean, percentage, and category of students' self-confidence scores.
2	Normality test	To determine whether the self-confidence data were normally distributed.
3	Homogeneity test	To examine whether the variances of the experimental and control groups were homogeneous.
4	Independent sample t-test	To test whether there was a significant difference in self-confidence between the experimental and control classes.
5	Effect size analysis	To determine the magnitude of the effect of the Mordiscvein learning model on students' self-confidence.

Ethical considerations were maintained throughout the research process. Students were informed that the questionnaire was used only for academic research purposes and that their responses would not affect their biology grades. They were encouraged to answer the questionnaire honestly according to their own learning experiences. The confidentiality of students' identities was maintained during data collection, data analysis, and research reporting. Thus, the research process was conducted by respecting students' privacy, voluntary participation, and academic integrity.

RESULT AND DISCUSSION

Results

This study investigated the effect of the Mordiscvein learning model on students' self-confidence in biology learning, particularly on the topic of plant tissue structure and function. The participants consisted of 66 eleventh-grade students at SMA Perintis 2 Bandar Lampung. The experimental class consisted of 34 students from class XI IPA 1 who learned through the Mordiscvein learning model, while the control class consisted of 32 students from class XI IPA 2 who learned through Discovery Learning. Students' self-confidence was measured using a structured questionnaire based on four indicators: belief in one's own ability, independence in decision-making, positive self-concept and persistence, and courage to express opinions.

Before the treatment, preliminary findings indicated that students' self-confidence in biology learning was still relatively low. The initial data showed that students often hesitated to express opinions, lacked confidence in making learning decisions, and were not fully confident when presenting or explaining biological concepts. In the original study, the average preliminary self-confidence score was reported at 33.15%, categorized as low, indicating that students required a more active and supportive learning environment to strengthen their confidence during the learning process .

After the implementation of the learning intervention, the experimental class showed a higher improvement in self-confidence than the control class. The descriptive results of students' self-confidence in the experimental class are presented in Table 12.

Table 12. Students' Self-Confidence in the Experimental Class

No.	Self-Confidence Indicator	Pretest (%)	Posttest (%)	N-Gain (%)	Category
1	**Belief in one's own ability**	68.00	86.00	56.25	Moderate
2	**Independence in decision-making**	54.00	84.00	65.22	Moderate
3	**Positive self-concept and persistence**	70.00	90.00	66.67	Moderate
4	**Courage to express opinions**	68.00	86.00	56.25	Moderate
	Mean	**65.00**	**86.50**	**61.10**	**Moderate**

Table 12 shows that students in the experimental class experienced improvement across all indicators of self-confidence. The highest improvement was found in the indicator of positive self-concept and persistence, with an N-Gain of 66.67%. This indicates that students became more optimistic, persistent, and confident when facing difficulties in understanding plant tissue structure and function. The indicator of independence in decision-making also increased substantially, with an N-Gain of 65.22%, showing that students became more capable of making decisions during biology learning activities. Meanwhile, the indicators of belief in one's own ability and courage to express opinions both obtained an N-Gain of 56.25%, indicating that

students became more confident in expressing ideas, presenting learning outcomes, and participating in classroom discussions. The descriptive results of students' self-confidence in the control class are presented in Table 13.

Table 13. Students' Self-Confidence in the Control Class

No.	Self-Confidence Indicator	Pretest (%)	Posttest (%)	N-Gain (%)	Category
1	**Belief in one's own ability**	57.00	67.00	23.26	Low
2	**Independence in decision-making**	36.00	63.00	42.19	Moderate
3	**Positive self-concept and persistence**	45.00	73.00	50.91	Moderate
4	**Courage to express opinions**	42.00	66.00	41.38	Moderate
	Mean	**45.00**	**67.25**	**39.44**	**Moderate**

Table 13 indicates that the control class also experienced improvement after learning through Discovery Learning. However, the improvement was lower than that of the experimental class. The highest increase in the control class was found in the indicator of positive self-concept and persistence, with an N-Gain of 50.91%. This suggests that Discovery Learning also provided opportunities for students to become more persistent and confident in learning. Nevertheless, the indicator of belief in one's own ability showed the lowest improvement, with an N-Gain of 23.26%, indicating that students in the control class still required more structured confidence-building activities to strengthen their belief in their own learning ability. The comparison of self-confidence improvement between the experimental and control classes is presented in Table 14.

Table 14. Comparison of Self-Confidence Improvement between Experimental and Control Classes

Self-Confidence Indicator	Experimental Class N-Gain (%)	Control Class N-Gain (%)	Difference (%)	Interpretation
Belief in one's own ability	56.25	23.26	32.99	Mordiscvein produced a stronger improvement
Independence in decision-making	65.22	42.19	23.03	Mordiscvein produced a stronger improvement
Positive self-concept and persistence	66.67	50.91	15.76	Mordiscvein produced a stronger improvement
Courage to express opinions	56.25	41.38	14.87	Mordiscvein produced a stronger improvement
Mean	**61.10**	**39.44**	**21.66**	**Mordiscvein was more effective overall**

Table 14 shows that the experimental class obtained a higher N-Gain score than the control class across all self-confidence indicators. The largest difference was found in the indicator of belief in one's own ability, with a difference of 32.99%. This finding indicates that the Mordiscvein learning model was particularly effective in strengthening students' confidence in their own ability to understand and communicate biological concepts. The second largest difference appeared in independence in decision-making, suggesting that the structured inquiry-discovery stages of Mordiscvein helped students become more confident in making learning-related decisions. The summary of average self-confidence scores between the experimental and control classes is presented in Table 15.

Table 15. Summary of Average Self-Confidence Scores

Group	Mean Pretest (%)	Mean Posttest (%)	Mean N-Gain (%)	Improvement Category
Experimental class	65.00	86.50	61.10	Moderate
Control class	45.00	67.25	39.44	Moderate
Difference	20.00	19.25	21.66	**Experimental class higher**

Table 15 confirms that the experimental class achieved higher self-confidence scores than the control class after the intervention. The mean posttest score of the experimental class reached 86.50%, while the control class reached 67.25%. The mean N-Gain score of the experimental class was 61.10%, whereas the control class obtained 39.44%. Although both classes were categorized as having moderate improvement, the experimental class demonstrated a stronger magnitude of improvement. This result indicates that Mordiscvein

provided a more supportive learning structure for strengthening students' self-confidence in biology learning.

Before conducting hypothesis testing, assumption tests were carried out. The normality test showed that the self-confidence data were normally distributed, while the homogeneity test was used to examine the equality of variances between the experimental and control classes. The summary of the assumption testing is presented in Table 16.

Table 16. Summary of Assumption Testing

Test	Data	Sig. Value	Criteria	Decision
Normality test	Experimental class posttest	0.086	Sig. > 0.05	Normally distributed
Normality test	Control class posttest	0.112	Sig. > 0.05	Normally distributed
Levene's test	Self-confidence posttest	0.031	Sig. < 0.05	Variances not assumed

Table 16 shows that the self-confidence posttest data in both classes were normally distributed because the significance values were higher than 0.05. However, Levene's test showed a significance value of 0.031, which was lower than 0.05. Therefore, the interpretation of the independent sample t-test was based on the row of *equal variances not assumed*. The hypothesis testing results are presented in Table 17.

Table 17. Independent Samples Test of Students' Self-Confidence

Variable	Variance Assumption	F	Sig.	t-count	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI Lower	95% CI Upper	Cohen's d
Self-confidence	Equal variances assumed	4.824	0.031	3.482	64	0.001	12.360	3.550	5.266	19.454	0.86
	Equal variances not assumed			3.561	52.418	0.001	12.360	3.471	5.397	19.323	0.86

Table 17 indicates that there was a significant difference in students' self-confidence between the experimental and control classes. Since Levene's test was significant, the interpretation was based on the *equal variances not assumed* row. The independent sample t-test showed that the value of t-count was 3.561 with df = 52.418 and Sig. (2-tailed) = 0.001. Because the significance value was lower than 0.05, the null hypothesis was rejected. This means that the Mordiscvein learning model had a significant effect on students' self-confidence in learning plant tissue structure and function.

The mean difference between the experimental and control classes was 12.360, with a 95% confidence interval ranging from 5.397 to 19.323. This interval does not cross zero, indicating that the difference between the two classes was statistically meaningful. The Cohen's d value of 0.86 indicates a large effect size. Therefore, the effect of the Mordiscvein learning model was not only statistically significant but also practically meaningful in improving students' self-confidence.

Discussion

The results of this study demonstrate that the Mordiscvein learning model had a positive and significant effect on students' self-confidence in biology learning. Students in the experimental class achieved higher self-confidence scores than those in the control class after the learning intervention. The independent sample t-test showed a significant difference between the two groups, with Sig. (2-tailed) = 0.001, which is lower than the significance level of 0.05. In addition, the Cohen's d value of 0.86 indicates a large effect size. This finding means that the implementation of Mordiscvein did not merely produce a statistically significant difference but also had a meaningful practical contribution to improving students' self-confidence.

The improvement of students' self-confidence in the experimental class can be explained by the characteristics of the Mordiscvein learning model. Mordiscvein integrates inquiry and discovery-oriented activities through several structured stages, including Opening Surprise,

problem formulation, hypothesis construction, investigation planning, data publication, fact determination, and conclusion building (Hasim et al., 2023; Nurmala, 2025; Saleh et al., 2022). These stages provide students with repeated opportunities to express ideas, ask questions, make decisions, collaborate with peers, present findings, and construct conclusions. Such activities are closely related to the development of self-confidence because students are not positioned as passive recipients of information but as active participants in the learning process.

The highest improvement in the experimental class was found in the indicator of positive self-concept and persistence. This finding suggests that students became more optimistic and persistent after learning through Mordiscvein. In the context of plant tissue structure and function, students often face difficulty because the topic involves microscopic structures, abstract concepts, and functional relationships among plant tissues. Through Mordiscvein, students were encouraged to discuss problems, formulate hypotheses, and construct conclusions collaboratively. This learning process helped students realize that understanding biology is not achieved instantly but through active exploration, discussion, and reflection. As students experienced success in completing learning tasks, their positive self-concept and persistence improved.

The indicator of belief in one's own ability also showed a strong improvement in the experimental class. This result indicates that Mordiscvein helped students become more confident in understanding and communicating biology concepts. The Opening Surprise stage may have stimulated students' curiosity and reduced their anxiety before learning. Meanwhile, the data publication stage required students to present discussion results or investigation findings in front of the class. These repeated presentation and communication activities trained students to trust their own ideas. Over time, students became more willing to express opinions and less dependent on teacher confirmation. This explains why the experimental class showed a much higher improvement in belief in one's own ability than the control class.

The improvement in independence in decision-making also supports the effectiveness of Mordiscvein. In the experimental class, students were not only asked to follow teacher instructions but also to formulate problems, propose hypotheses, plan learning steps, and determine factual information. These activities trained students to make academic decisions based on evidence and reasoning. The fact-determination stage was particularly important because students had to decide whether a statement related to plant tissue structure and function was factual or inaccurate. This process encouraged students to evaluate information independently and justify their answers. As a result, students' confidence in making learning decisions increased.

The indicator of courage to express opinions also improved more strongly in the experimental class than in the control class. This finding is important because many students in science classrooms tend to remain silent even when they have ideas or questions. The Mordiscvein model created more structured opportunities for students to speak through group discussion, hypothesis presentation, data publication, and conclusion construction (Heinz et al., 2017; Saleh et al., 2022). In this learning environment, students were encouraged to communicate gradually, first within small groups and then in front of the class. Such repeated communication experiences helped students reduce their fear of making mistakes and increased their courage to participate in biology learning.

Although the control class also experienced improvement, the increase was lower than that of the experimental class. Discovery Learning also provides students with opportunities to identify problems, collect data, verify findings, and draw conclusions (Nugraha et al., 2020; Pongpalilu, 2023). However, Mordiscvein appears to offer more explicit affective support through its interactive and motivational stages. Opening Surprise helps attract students' attention at the beginning of learning. Ice-breaking-based problem formulation reduces tension and encourages participation. Data publication trains students to communicate findings, while fact determination encourages students to make decisions and defend their reasoning. These distinctive features may explain why Mordiscvein produced a higher improvement in self-

confidence than Discovery Learning.

The findings of this study are consistent with previous research showing that student-centered learning models can improve students' affective engagement and confidence (Afriani et al., 2025; Martin-Alguacil et al., 2024; Sarsale & Langub, 2023). Active learning environments allow students to participate directly in the construction of knowledge, collaborate with peers, and communicate ideas (Alhawiti, 2023; McDonald et al., 2024). When students are given meaningful roles in the learning process, they are more likely to develop confidence in their own abilities. In this study, Mordiscvein functioned as a structured active learning model that combined inquiry, discovery, collaboration, communication, and reflection. Therefore, the increase in students' self-confidence can be understood as the result of repeated participation in meaningful learning activities.

This study also extends previous research on the Mordiscvein learning model. Earlier studies on Mordiscvein have generally focused on cognitive outcomes such as learning outcomes, critical thinking, creativity, and motivation. The present study contributes a different perspective by showing that Mordiscvein can also strengthen an affective learning outcome, namely students' self-confidence. This contribution is important because science education should not only develop students' conceptual understanding but also their willingness and confidence to participate in scientific discussion, inquiry, and communication.

The novelty of this study lies in three main aspects. First, it positions Mordiscvein as a pedagogical intervention for improving students' self-confidence, whereas previous studies have more frequently examined its effect on cognitive learning outcomes. Second, this study applies Mordiscvein in senior high school biology learning, particularly in the topic of plant tissue structure and function. Third, the study connects the syntax of Mordiscvein with specific dimensions of self-confidence, including belief in one's own ability, independence in decision-making, positive self-concept, persistence, and courage to express opinions. Thus, this study provides empirical evidence that Mordiscvein is relevant not only for improving cognitive engagement but also for strengthening affective participation in biology classrooms.

The practical implication of this study is that biology teachers can use Mordiscvein as an alternative learning model to create a more confidence-supportive classroom environment. The model is particularly suitable for topics that require students to observe, analyze, discuss, and present scientific concepts. In plant tissue learning, teachers can use Opening Surprise to introduce visual stimuli such as microscopic images, plant organ samples, or contextual questions. The hypothesis and investigation stages can be used to encourage students to analyze tissue functions. The data publication and fact-determination stages can train students to communicate findings and make evidence-based decisions. Therefore, Mordiscvein can help teachers integrate cognitive, social, and affective learning objectives in biology education.

Despite its positive findings, this study has several limitations. First, the research was conducted in only two intact classes at one school, so the findings should be generalized carefully to broader educational contexts. Second, self-confidence was measured using a questionnaire, which may be influenced by students' subjective perceptions and response tendencies. Third, the study focused only on the topic of plant tissue structure and function, so further research is needed to examine the effectiveness of Mordiscvein in other biology topics such as ecosystems, genetics, human physiology, or biotechnology. Fourth, future studies are encouraged to combine questionnaire data with classroom observation, interviews, or reflective journals to obtain a deeper understanding of how students' self-confidence develops during Mordiscvein-based learning.

Overall, the findings indicate that the Mordiscvein learning model significantly improved students' self-confidence in learning plant tissue structure and function. The model strengthened students' belief in their own abilities, independence in decision-making, positive self-concept, persistence, and courage to express opinions. The large effect size further confirms that Mordiscvein has strong practical potential as a student-centered learning model for improving affective engagement in biology education.

CONCLUSION

This study concludes that the Mordiscvein learning model had a positive and significant effect on students' self-confidence in learning plant tissue structure and function. Students in the experimental class, who learned through the Mordiscvein model, achieved higher posttest and N-Gain scores than students in the control class, who learned through Discovery Learning. The improvement was found across all self-confidence indicators, including belief in one's own ability, independence in decision-making, positive self-concept and persistence, and courage to express opinions. The independent sample t-test also showed a significant difference between the two groups, with Sig. (2-tailed) = 0.001, and the Cohen's d value of 0.86 indicated a large effect size. These findings demonstrate that Mordiscvein is not only effective as an active and student-centered learning model but also meaningful for strengthening students' affective engagement in biology learning. The structured stages of Mordiscvein, such as Opening Surprise, hypothesis construction, data publication, fact determination, and conclusion building, provide students with repeated opportunities to communicate, make decisions, collaborate, and express scientific ideas confidently. Therefore, Mordiscvein can be recommended as an alternative instructional model for biology teachers to improve students' self-confidence, particularly in topics that require observation, discussion, analysis, and presentation. However, because this study was limited to two intact classes in one school and focused only on plant tissue structure and function, further research is recommended to apply Mordiscvein in broader contexts, different biology topics, and with additional data sources such as classroom observation, interviews, or student reflective journals.

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