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Implementation of Guided Inquiry Integrated With Student Worksheets on Animal Tissue: An Analysis of Grade XI Students' Conceptual Mastery

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Abstract: This study aimed to analyze changes in Grade XI students' conceptual mastery after the implementation of guided inquiry integrated with Student Worksheets (LKPD) on animal tissue and to compare learning outcomes between groups. A quasi-experimental method with a nonequivalent control group pretest-posttest design was employed, involving 48 students: 24 in the experimental group and 24 in the control group. Conceptual mastery was assessed using seven essay questions covering cognitive levels C1-C4. The experimental group's mean score changed from 73 on the pretest to 74 on the posttest, whereas the control group's mean remained at 68. In the experimental group, achievement in understanding (C2) and applying (C3) increased by 8 percentage points each, C1 remained unchanged, and C4 decreased by 3 percentage points. The Mann-Whitney U test indicated a between-group difference in learning outcomes ($U = 158.500$; $Z = -2.765$; $p = 0.006$), with an effect size of $r \approx 0.40$. Because the groups were not randomized and their pretest means differed, the result was interpreted cautiously as a between-group difference associated with the instructional implementation rather than as causal evidence that fully controlled for initial ability. Descriptively, the most apparent improvements occurred in understanding and applying, whereas analyzing appeared to require more structured scaffolding.

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INTRODUCTION

Conceptual mastery is a major learning outcome in biology because it enables students to explain phenomena, connect structure and function, and apply knowledge in new situations. In the topic of animal tissue, these demands become more complex because students must relate microscopic structural characteristics to tissue functions, distinguish among tissue types, and use this information to explain structure-function relationships. Instruction dominated by information delivery and memorization may result in superficial understanding, making it difficult for students to use concepts in new contexts (Doyan et al., 2024; Rahayu et al., 2023; Mursali et al., 2024).

Observations and interviews conducted at SMA Negeri 3 Mataram indicated that students' conceptual mastery was not yet optimal. Students tended to rely on textbooks when answering questions, had difficulty explaining the material in their own words, and only some actively participated in discussions. In the context of animal tissue, these conditions suggest a need for instruction that requires students not only to recall tissue names or characteristics but also to interpret evidence, connect structure with function, and use concepts to explain problems. Learning activities involving observation, investigation,

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analysis, and evidence-based explanation are therefore relevant to these needs (Anam et al., 2019; Rahayu et al., 2022; Suantara et al., 2022).

One instructional model that can address these issues is guided inquiry. This model directs students to formulate problems and hypotheses, conduct investigations, collect and analyze data, and draw conclusions. The teacher continues to provide guiding questions and gradual assistance so that the investigation remains aligned with the learning objectives. This process allows students to construct concepts through experience and evidence rather than merely receiving explanations from the teacher. Previous studies have shown that guided inquiry can support students' understanding and conceptual mastery (Sulastri et al., 2025; Zaenuri et al., 2025; Amini et al., 2022; Chotimah et al., 2023; Ibnusaputra et al., 2023; Nasir et al., 2022).

Implementing guided inquiry requires instructional materials that can systematically direct students' activities. Student Worksheets (LKPD) designed according to the inquiry syntax can function as scaffolding by presenting phenomena or problems, guiding questions, spaces for recording observations or data, analytical steps, and conclusion-drawing activities. This scaffolding helps students move from observing evidence to explaining concepts: guiding questions support understanding (C2), using data to solve tasks supports applying (C3), and analyzing relationships among evidence targets analyzing (C4). Thus, the worksheets do not merely serve as practice sheets but as structured guides that organize the inquiry process (Fahlevi et al., 2022; Windiastuti et al., 2018; Saputro et al., 2020; Sholahuddin et al., 2024).

Previous research on guided inquiry and student worksheets has largely focused on instructional-material development, scientific literacy, critical thinking, argumentation, scientific communication, and science process skills (Setyaningsih et al., 2019; Pitorini et al., 2020; Aiman et al., 2020; Hisyam & Handayani, 2024; Ilhamdi et al., 2020; Saputro et al., 2020). The contribution of the present study lies not merely in its research setting, but in the use of worksheets as scaffolding that explicitly follows the stages of guided inquiry in the animal-tissue topic and in mapping the outcomes onto conceptual-mastery indicators C1-C4. This study therefore aimed to analyze the pattern of students' conceptual mastery following the implementation of this instructional approach.

RESEARCH METHOD

Research Design

This study employed a quantitative approach using a quasi-experimental method. A nonequivalent control group pretest-posttest design was used because the study involved pre-existing experimental and control classes without individual randomization. The experimental group received guided inquiry instruction integrated with Student Worksheets (LKPD), whereas the control group received the instruction routinely implemented by the teacher. The research design is presented in Table 1.

Table 1. Research design

Group	Pretest	Treatment	Posttest
Experimental	O_1	X_1	O_2
Control	O_3	X_2	O_4

Notes:

- O_1 and O_3: initial test (pretest) of conceptual mastery before instruction;
- O_2 and O_4: final test (posttest) of conceptual mastery after instruction;
- X_1: guided inquiry instruction integrated with Student Worksheets (LKPD);
- X_2: instruction routinely implemented by the teacher.

Population and Sample

The population comprised all Grade XI students at SMA Negeri 3 Mataram in the 2024/2025 academic year. The sample consisted of two classes: Class XI A as the experimental group and Class XI B as the control group, with 24 students in each group and a total sample of 48 students. The classes were selected using purposive sampling based on prior learning records, class characteristics, and teacher recommendations. The pretest means indicated different initial abilities between the groups, with a mean of 73 in the experimental group and 68 in the control group; this baseline difference was considered when interpreting the results.

Research Setting

The study was conducted in September 2024 at SMA Negeri 3 Mataram. The instructional topic was animal tissue.

Research Instruments

The primary research instrument was a conceptual-mastery test administered before and after instruction. The test consisted of seven essay questions based on the revised Bloom's taxonomy and covered remembering (C1), understanding (C2), applying (C3), and analyzing (C4). The same instrument was used for both the pretest and posttest to maintain consistency across the measured indicators.

The instructional treatment used Student Worksheets (LKPD) designed according to the stages of guided inquiry: problem orientation, problem formulation, hypothesis formulation, data collection, data analysis, and conclusion drawing. For the animal-tissue topic, the worksheets organized learning activities through the presentation of phenomena or problems, investigative questions, recording of observations or data, analysis of relationships among the information obtained, and evidence-based conclusions. This structure was intended to function as scaffolding that helps students move from observing evidence to constructing and using concepts. The test instrument and worksheets were validated by experts in terms of content, construction, language, and alignment with the learning objectives.

Research Procedure

The study was conducted in three stages. During the preparation stage, the researchers developed the instructional materials, Student Worksheets (LKPD), and conceptual-mastery test. During implementation, both groups completed a pretest to assess initial conceptual mastery. The experimental group then participated in guided inquiry instruction integrated with the worksheets, whereas the control group received the teacher's routine instruction through discussion and question-and-answer activities. After the instructional period, both groups completed a posttest. In the final stage, the pretest and posttest data were analyzed to describe changes and test differences in learning outcomes between the groups.

Data Collection

Conceptual-mastery data were collected using a test. The pretest was administered before the treatment to assess students' initial conceptual mastery, whereas the posttest was administered after the treatment to assess conceptual mastery following instruction. Students' responses were scored using a scoring guide prepared for each item.

Data Analysis

The data were analyzed descriptively and inferentially. Descriptive analysis included the mean, minimum score, maximum score, and pretest-posttest score changes in the experimental and control groups. Normality was assessed using the Shapiro-Wilk test because each group consisted of 24 students. Data were considered normally distributed when $p > 0.05$. Homogeneity of variance was assessed using Levene's test at a significance level of 0.05. Inferential analysis used the Mann-Whitney U test to compare learning-outcome scores between groups because the parametric assumptions were not fully met. In the SPSS output, the analyzed variable was labeled "learning outcome"; because the label did not specify whether the score represented a posttest score or a derived score, the inferential result is reported according to the statistical output and interpreted cautiously. The Mann-Whitney U test does not adjust for differences in pretest scores; therefore, the result is not treated as a causal estimate adjusted for initial ability.

Research Hypotheses

The null hypothesis (H_0) stated that there was no difference in learning-outcome scores between the experimental and control groups, whereas the alternative hypothesis (Ha) stated that there was a difference between the two groups. H_0 was rejected when the significance value was less than 0.05.

RESULT AND DISCUSSION

The pretest and posttest results for both groups are presented in Table 2.

Table 2. Pretest and posttest scores of the experimental and control groups

No.	Group		Number of students	Minimum score	Maximum score	Mean
1.	Experimental	*Pretest*	24	62.07	82.76	73
		Posttest	24	55.17	86.21	74
2.	Control	*Pretest*	24	58.62	75.86	68
		Posttest	24	58.62	75.86	68

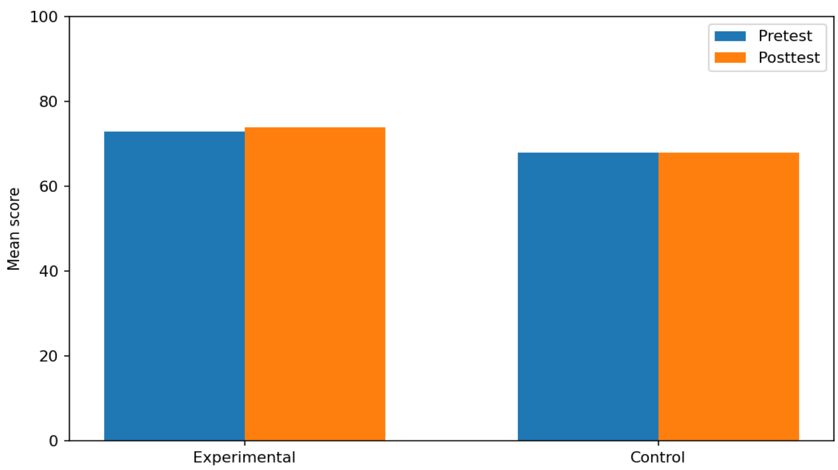

Figure 1. Mean pretest and posttest scores of the experimental and control groups

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The mean pretest score was 73 in the experimental group and 68 in the control group, whereas the corresponding posttest means were 74 and 68. These data show that the experimental group started with a higher score and also ended with a higher score. Because the initial difference was already present before the treatment, interpretation of the results must account for the baseline rather than relying solely on a simple comparison of posttest scores.

The pretest and posttest consisted of seven essay questions representing C1-C4 indicators of the revised Bloom's taxonomy. The percentage achievement for each indicator is presented in Table 3.

Table 3. Percentage achievement and change (Δ) in students' conceptual mastery on the pretest and posttest in the experimental and control groups

No	Indicator	Percentage achievement				Δ Exp.	Δ Ctrl.
		Experimental group		Control group			
		Pretest	*Posttest*	*Pretest*	*Posttest*		
1.	Remembering (C1)	35	35	60	64	0	+4
2.	Understanding (C2)	71	79	42	46	+8	+4
3.	Applying (C3)	80	88	79	80	+8	+1
4.	Analyzing (C4)	90	87	85	88	-3	+3

In the experimental group, the changes were C1 = 0 points, C2 = +8 points, C3 = +8 points, and C4 = -3 points. In the control group, the changes were C1 = +4 points, C2 = +4 points, C3 = +1 point, and C4 = +3 points. These patterns are visualized in Figures 2 and 3.

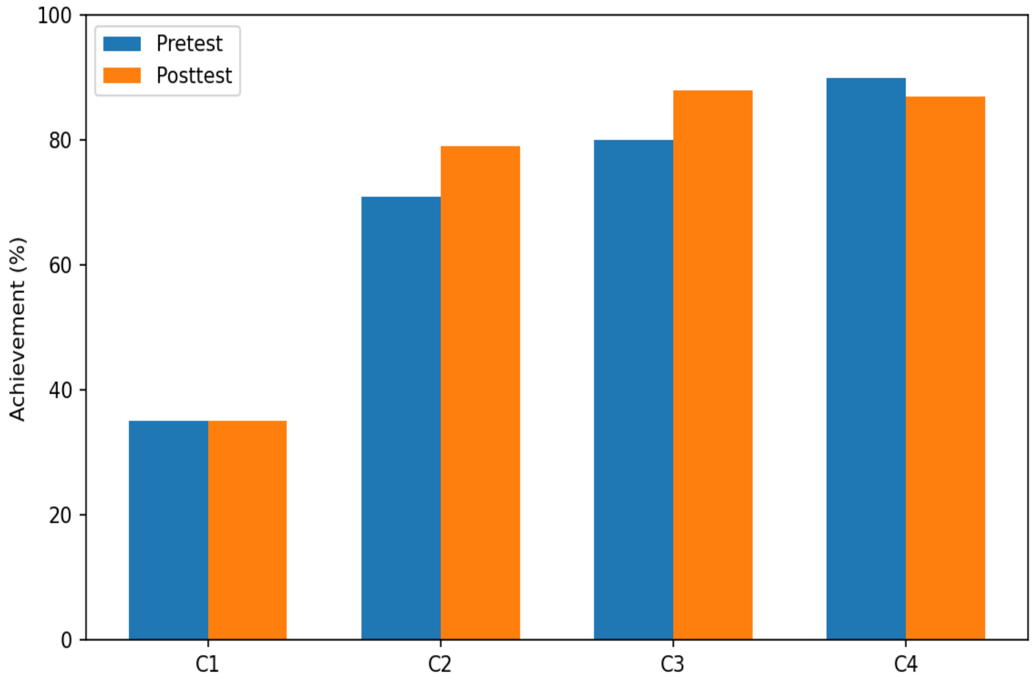

Figure 2. Conceptual-mastery achievement by indicator in the experimental group

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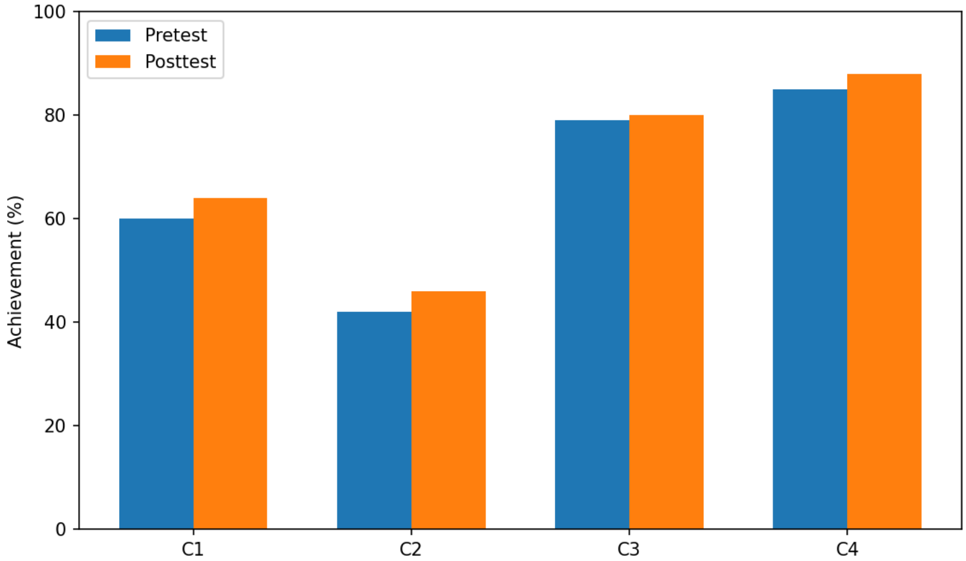

Figure 3. Conceptual-mastery achievement by indicator in the control group

After the pretest and posttest data were obtained, inferential analysis was conducted to test differences in outcomes between the experimental and control groups. Assumption checks were used to determine the appropriate statistical procedure. Normality was assessed using the Shapiro-Wilk test and homogeneity of variance using Levene's test. Because the parametric assumptions were not fully satisfied, between-group differences in learning-outcome scores were analyzed using the nonparametric Mann-Whitney U test.

Normality Test of Students' Conceptual Mastery

The normality-test results are presented in Table 4. Based on the Shapiro-Wilk test, data were considered normally distributed when $p > 0.05$. The experimental-group pretest had $p = 0.030$ and was therefore not normally distributed, whereas the control-group pretest had $p = 0.105$ and was normally distributed. The experimental-group posttest had $p = 0.075$ and the control-group posttest had $p = 0.080$; both values exceeded 0.05, indicating that the posttest scores of both groups were normally distributed according to the Shapiro-Wilk test.

Thus, not all datasets met the normality assumption. The homogeneity test was subsequently considered together with this information when selecting the inferential analysis.

Table 4. Data normality test

Group	Kolmogorov-Smirnov			Shapiro-Wilk			Distribution
	Statistic	df	Sig	Statistic	Df	Sig	
Experimental-group pretest	0.159	24	0.117	0.907	24	0.030	Non-normal
Control-group pretest	0.117	24	0.049	0.931	24	0.105	Normal
Experimental-group posttest	0.188	24	0.027	0.925	24	0.075	Normal
Control-group posttest	0.239	24	0.01	0.880	24	0.08	Normal

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Homogeneity Test of Conceptual Mastery

The homogeneity test was used to assess equality of variance in learning-outcome scores between groups. The results are presented in Table 5.

Table 5. Data homogeneity test

	Levene Statistic	df1	df2	Sig.
Based on Mean	12.206	1	46	0.001
Based on Median	10.690	1	46	0.002
Based on Median and with adjusted df	10.690	1	43.530	0.002
Based on trimmed mean	12.664	1	46	0.001

Levene's test based on the mean yielded $p = 0.001 < 0.05$, indicating that the variance in learning-outcome scores was not homogeneous between groups.

Hypothesis Test of Conceptual Mastery

Differences in learning-outcome scores between the experimental and control groups were tested using the Mann-Whitney U test. In the SPSS output, the analyzed variable was labeled "learning outcome". The significance value was used to determine whether a between-group difference was present. The Mann-Whitney U test results are presented in Table 6.

Table 6. Mann-Whitney U test results

	Learning outcome
Mann-Whitney U	158.500
Wilcoxon W	458.500
Z	-2.765
Asymp. Sig. (2-tailed)	.006

As shown in Table 6, the Mann-Whitney U value was 158.500, $Z = -2.765$, and Sig. (2-tailed) = 0.006. Because $p < 0.05$, the results indicate a difference in learning-outcome scores between the experimental and control groups. Based on the Z value and the total sample size of 48, the effect size was $r \approx 0.40$. This result should be considered together with the pretest data, which showed different initial abilities between the two groups; therefore, the statistical difference is not interpreted as causal evidence that fully controls for baseline conditions.

Discussion

Conceptual mastery in this study was examined through remembering, understanding, applying, and analyzing. The results showed that changes were not uniform across all cognitive levels. This pattern is important because the success of guided inquiry should not be judged solely from a total score but also from the cognitive processes most strongly supported during instruction.

In general, guided inquiry provides opportunities for students to construct concepts through guiding questions, information gathering, analysis, and conclusion drawing. When the Student Worksheets function as scaffolding, these stages can help students organize evidence and connect it with the concepts being studied. This interpretation is consistent with findings showing that guided inquiry supported by scaffolding can promote conceptual mastery (Rahayu et al., 2022; Mursali et al., 2024).

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In this study, the experimental group showed the most pronounced increases in C2 and C3, each by 8 percentage points. This pattern suggests that the structure of the worksheets strongly supported understanding information and using concepts than merely recalling facts. This finding is consistent with studies showing that guided inquiry supported by worksheets can promote conceptual mastery and the use of knowledge in completing tasks (Ibnusaputra et al., 2023; Chotimah et al., 2023).

The experimental group's posttest mean (74) was higher than that of the control group (68), but the experimental group's pretest mean was also higher (73 versus 68). Therefore, the higher final score cannot be separated entirely from the initial difference. The discussion below consequently focuses on indicator-level change patterns and instructional mechanisms that may help explain those patterns.

Previous studies have shown that guided inquiry can support conceptual mastery when students are given opportunities to investigate, test ideas, and construct explanations (Sarwi et al., 2016; Zaenuri et al., 2025). In the present study, the Student Worksheets played an important role in directing the inquiry process while keeping it aligned with the conceptual objectives of the animal-tissue topic.

The increase in C2 may be explained by activities that required students to understand relationships among information and interpret evidence through questions in the worksheets. The increase in C3 indicates that students had opportunities to use concepts they had understood to complete tasks or explain situations. Guided inquiry accompanied by worksheets encourages students to move from receiving information toward actively using concepts (Fahlevi et al., 2022; Windiastuti et al., 2018).

In contrast, C1 in the experimental group did not change, while C4 decreased by 3 points. The lack of change in C1 may reflect the fact that inquiry instruction allocates more activity to meaning making and concept use than to practice in reproducing information. The decline in C4 suggests that analytical tasks impose greater cognitive demands and may require more intensive guiding questions, time, and analytical practice so that students can distinguish evidence, connect tissue characteristics, and construct coherent explanations.

Accordingly, the teacher's role as a facilitator remains important. Scaffolding should be provided gradually, particularly when students encounter more complex analytical tasks. Insufficient support may make it difficult for students to organize evidence, whereas overly dominant support may reduce the independence expected in inquiry. This principle of gradual assistance is consistent with the use of scaffolding in guided inquiry to support conceptual mastery (Rahayu et al., 2022).

Indicator-level analysis provides a more detailed view of students' responses to instruction across C1-C4.

Remembering (C1)

For remembering (C1), the experimental group remained at 35% from pretest to posttest, whereas the control group increased from 60% to 64%. This result indicates that the treatment did not provide an advantage in reproducing information during the observed instructional period.

Understanding (C2)

For understanding (C2), the experimental group increased from 71% to 79% (+8 points), whereas the control group increased from 42% to 46% (+4 points). The larger increase in the experimental group is consistent with the function of guiding questions and interpretive activities in the worksheets, which help students construct meaning from the information obtained. The C2 pattern suggests that active engagement needs to be directed toward meaning making rather than merely participation in classroom activities.

Applying (C3)

For applying (C3), the experimental group increased from 80% to 88% (+8 points), whereas the control group increased from 79% to 80% (+1 point). This result indicates that inquiry activities provided greater opportunities for students to use concepts in application-based tasks, consistent with reports that guided inquiry can strengthen conceptual mastery through investigation and the use of evidence (Sulastri et al., 2025; Ibnusaputra et al., 2023).

Analyzing (C4)

For analysis (C4), the experimental group decreased from 90% to 87% (-3 points), whereas the control group increased from 85% to 88% (+3 points). Therefore, it would be inaccurate to state that C4 improved in the experimental group. This finding points to the need for stronger scaffolding for analytical tasks, including questions that help students identify relevant information, connect evidence, and justify conclusions.

Overall, the experimental group showed its largest increases in C2 and C3 (+8 points), no change in C1, and a decrease in C4 (-3 points). The control group increased in C1 and C2 (+4 points), C4 (+3 points), and C3 (+1 point). These patterns indicate that instructional effects differ across cognitive skills.

Accordingly, the claim that the control group improved more than the experimental group overall is not supported by the complete pattern of data. The control group showed greater change in C1 and C4, whereas the experimental group showed more pronounced change in C2 and C3. A more appropriate interpretation is that the two instructional approaches produced different profiles of change.

The C2 and C3 findings are consistent with the characteristics of guided inquiry, which emphasizes discovering and constructing concepts through investigation rather than simply receiving information. Previous studies have also reported contributions of guided inquiry to conceptual mastery and students' cognitive activity (Sarwi et al., 2016; Rahayu et al., 2023).

However, the C4 result shows that the presence of an inquiry syntax alone does not guarantee improvement in analytical ability. The quality of guiding questions, the complexity of the content, students' prior experience with inquiry learning, and the available time should be considered when designing worksheets for higher-order cognitive skills.

The implication is that inquiry-based worksheets on animal tissue should balance scaffolding for understanding, applying, and analyzing. Stepwise questions that connect evidence with concepts can be maintained for C2-C3, whereas C4 requires more explicit analytical tasks and repeated practice.

Statistical analysis complements the descriptive pattern rather than replacing the conceptual interpretation. Assumption checks showed that not all datasets were normally distributed and that the variance of learning-outcome scores was not homogeneous.

The Mann-Whitney U test yielded $U = 158.500$, $Z = -2.765$, and $p = 0.006$, with an effect size of $r \approx 0.40$. This finding indicates a between-group difference between the available learning-outcome variables. However, because the groups were not randomized, their pretest means differed, and the Mann-Whitney test did not adjust for baseline scores, the result should still be interpreted cautiously.

Thus, the main contribution of this study lies in describing the C1-C4 change profile after the implementation of guided inquiry integrated with Student Worksheets, particularly the stronger change in C2-C3 and the need to improve scaffolding for C4.

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The discussion also indicates that evaluation of instructional models should not rely only on total scores; conceptual indicators should also be considered so that the strengths and limitations of an intervention can be identified more specifically.

These findings can inform improvements to the worksheets by clarifying analytical questions, providing more structured evidence-processing steps, and allowing sufficient adaptation time for students who are not yet accustomed to inquiry learning.

Inferentially, a difference in learning-outcome scores was found between groups, while descriptively the more pronounced changes in the experimental group occurred in C2 and C3. Claims about instructional success should therefore be formulated specifically in relation to the indicators that improved.

Guided inquiry integrated with Student Worksheets may be used in biology instruction to encourage students' engagement in constructing and using concepts, if scaffolding for analytical ability is strengthened.

CONCLUSION

The implementation of guided inquiry integrated with Student Worksheets on animal tissue produced different patterns of change in conceptual mastery across indicators. The experimental group showed its largest increases in understanding (C2) and applying (C3), each by 8 percentage points, no change in C1, and a 3-point decrease in C4. The Mann-Whitney U test indicated a difference in learning-outcome scores between groups ($U = 158.500$; $Z = -2.765$; $p = 0.006$; $r \approx 0.40$). Because the groups differed in initial ability and the analysis did not adjust for pretest scores, the inferential finding should be interpreted cautiously. Descriptively, the more pronounced changes in the experimental group occurred in understanding and applying concepts, whereas analyzing appeared to require more structured scaffolding.

RECOMMENDATIONS

Future studies should control differences in students' initial ability and provide clearer reporting of the analyzed learning-outcome scores and key methodological procedures. In practice, guided inquiry worksheets should maintain structured support for understanding and applying concepts while strengthening analytical tasks, evidence interpretation, and scaffolding to better support students' C4 performance.

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REFERENCES

Aiman, U., Hasyda, S., & Uslan. (2020). The influence of Process Oriented Guided Inquiry Learning model assisted by realia media to improve scientific literacy and critical thinking skill of primary school students. *European Journal of Educational Research, 9*(4), 1635–1647. https://doi.org/10.12973/eu-jer.9.4.1635

Amini, F. N., Roektiningroem, E., & Wilujeng, I. (2022). Development of student worksheet based on guided inquiry assisted by PhET simulation to improve concept comprehension. *Journal of Science Education Research, 6*(1), 46–50. https://doi.org/10.21831/jser.v6i1.48244

Anam, A. C., Wiyanto, W., & Alimah, S. (2019). The analysis of students' conceptual understanding and motivation in guided inquiry science learning model assisted by Android virtual laboratory. *Journal of Innovative Science Education, 8*(2), 163–172. https://doi.org/10.15294/jise.v0i0.27712

Chotimah, A. N., Setyawarno, D., & Rosana, D. (2023). Effect of guided inquiry model by PhET simulations worksheet on science process skills and mastery of concepts. *Journal of Science Education Research, 7*(2), 100–105. https://doi.org/10.21831/jser.v7i2.63953

Doyan, A., Susilawati, S., Annam, S., Muliyadi, L., Megahati, R. R. P., Hutabarat, R. A., Ikhsan, M., & Ardianti, N. R. (2024). The trends research of conceptual mastery in students' physics learning (2015–2024): A systematic review. *Jurnal Penelitian Pendidikan IPA, 10*(6), 323–332. https://doi.org/10.29303/jppipa.v10i6.7827

Fahlevi, A., Jumadi, Dewi, A. N., & Sari, F. P. (2022). Development of electronic student worksheet based on guided inquiry on the topic of photosynthesis. *Jurnal Penelitian Pendidikan IPA, 8*(3), 1408–1415. https://doi.org/10.29303/jppipa.v8i3.1674

Hisyam, M., & Handayani, S. (2024). The influence of guided inquiry learning in the context of socio-scientific issues on students' chemistry literacy and environmental awareness. *Jurnal Penelitian Pendidikan IPA, 10*(8), 5877–5884. https://doi.org/10.29303/jppipa.v10i8.7369

Ibnusaputra, M., Wilujeng, I., & Kuswanto, H. (2023). Development of electronic worksheet guided inquiry to reduce misconceptions and improve high school students' concept mastery on straight motion material. *Jurnal Penelitian Pendidikan IPA, 9*(5), 2653–2663. https://doi.org/10.29303/jppipa.v9i5.2738

Ilhamdi, M. L., Novita, D., & Rosyidah, A. N. K. (2020). Pengaruh model pembelajaran inkuiri terbimbing terhadap kemampuan berpikir kritis IPA siswa sekolah dasar. *Kontekstual: Jurnal Pendidikan, 1*(2), 49–57. https://doi.org/10.46772/kontekstual.v1i02.162

Mursali, S., Hastuti, U. S., Zubaidah, S., & Rohman, F. (2024). Guided inquiry with Moodle to improve students' science process skills and conceptual understanding. *International Journal of Evaluation and Research in Education, 13*(3), 1875–1884. https://doi.org/10.11591/ijere.v13i3.27617

Nasir, M., Cari, C., Sunarno, W., & Rahmawati, F. (2022). The effect of STEM-based guided inquiry on light concept understanding and scientific explanation. *EURASIA Journal of Mathematics, Science and Technology Education, 18*(11), em2175. https://doi.org/10.29333/ejmste/12499

Pitorini, D. E., Suciati, S., & Ariyanto, J. (2020). Kemampuan argumentasi siswa: Perbandingan model pembelajaran inkuiri terbimbing dan inkuiri terbimbing dipadu dialog Socrates. *Jurnal Inovasi Pendidikan IPA, 6*(1), 26–38. https://doi.org/10.21831/jipi.v6i1.27761

Rahayu, M., Asyhari, A., & Anjani, A. V. (2022). Scaffolding in guided inquiry learning with Google Classroom: Effect on physics conceptual understanding. *Jurnal Inovasi Pendidikan IPA, 8*(2), 174–184. https://doi.org/10.21831/jipi.v8i2.48365

Rahayu, R., Siswanto, S., Ramadhanti, C. A., & Subali, B. (2023). Guided inquiry learning model using scientific argumentation activities to improve concept understanding on optical and light. *Jurnal Pendidikan Fisika Indonesia, 19*(1), 55–64. https://doi.org/10.15294/jpfi.v19i1.36626

Saputro, T., Herlina, K., & Distrik, I. W. (2020). Guided inquiry based students' worksheet to grow students' critical thinking and communication skills. *Indonesian Journal of Science and Mathematics Education, 3*(1), 18–26. https://doi.org/10.24042/ijsme.v3i1.5146

Sarwi, S., Sutardi, S., & Prayitno, W. W. (2016). Implementation of guided inquiry physics instruction to increase an understanding concept and to develop the students' character conservation. *Jurnal Pendidikan Fisika Indonesia, 12*(1), 1–7. https://doi.org/10.15294/jpfi.v12i1.4264

Setyaningsih, A., Rahayu, S., Fajaroh, F., & Parmin. (2019). Pengaruh Process Oriented-Guided Inquiry Learning berkonteks isu sosiosaintifik terhadap keterampilan berargumentasi siswa sekolah menengah atas. *Jurnal Inovasi Pendidikan IPA, 5*(2), 168–179. https://doi.org/10.21831/jipi.v5i2.20693

Sholahuddin, A., Normina, N., & Iriani, R. (2024). Improving students' scientific literacy: Development of guided inquiry-based student worksheets on buffer solution material. *Jurnal Pendidikan Kimia, 16*(2), 152–158. https://doi.org/10.24114/jpkim.v16i2.56718

Suantara, I. K. T., Hartono, & Susilaningsih, E. (2022). The effectiveness of guided inquiry learning model using TPS approach of science process skills and conceptual understanding. *International Journal of Elementary Education, 6*(3), 403–411. https://doi.org/10.23887/ijee.v6i3.49345

Sulastri, S., Rasul, M. S., Juliana, J., Syahrial, S., & Zatya, I. (2025). STEM-based guided inquiry in colloid practicums and its influence on students' concept mastery. *Jurnal Pendidikan IPA Indonesia, 14*(2), 296–303. https://doi.org/10.15294/jpii.v14i2.23967

Windiastuti, E. P., Suyono, S., & Kuntjoro, S. (2018). Development of the guided inquiry student worksheet for biology grade 11th senior high school. *Jurnal Penelitian Pendidikan Sains, 7*(2), 1513–1518. https://doi.org/10.26740/jpps.v7n2.p1513-1518

Zaenuri, M., Saptono, S., & Subali, B. (2025). Implementation of the guided inquiry learning model through experiments to improve conceptual understanding and critical thinking. *Unnes Science Education Journal, 14*(1), 59–68. https://doi.org/10.15294/usej.v14i1.20015