

# Enhancing Learners' Engagement and Higher-Order Thinking Skills in Biology 2 Through the Question-Answer-Relationship (QAR) Strategy

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**Abstract**—This study, titled “Enhancing Learners’ Engagement and Higher-Order Thinking Skills (HOTS) in Biology 2 Through the Question-Answer Relationship (QAR) Strategy,” aims to assess the level of utilization of the QAR strategy, as well as learners’ engagement and higher-order thinking skills (HOTS) while using the QAR strategy in Biology 2. It examines the relationship between utilization of QAR and learners’ engagement and its effect on learners’ HOTS. The respondents of the study were 100 senior high school STEM students purposively chosen based on their enrolled subjects and their relevance to the research objectives. The research utilized researcher-made survey questionnaires and tests as instruments, while statistical analyses included mean, SD, frequency, percentage, Pearson correlation and regression analysis. The findings revealed that QAR strategy is highly utilized across all measured dimensions. It is also revealed that the level of learners’ engagement in Biology 2 is generally very high across all dimensions except behavioral engagement with only high. This may be attributed to the students’ adaptation to new activities or the nature of classroom participation. It is also found that learners generally demonstrated a Very Satisfactory level of HOTS across all components assessed. Correlation analysis revealed significant positive relationships between the implementation of the QAR Strategy and learners’ engagement, while regression analysis showed its significant effect on HOTS. The study results in both hypotheses being rejected due to the significant relationships and effects found between the strategy and learners’ engagement and HOTS, respectively. It demonstrates that QAR effectively improves students’ ability to think critically by helping them respond to questions more accurately. Therefore, it is recommended that science teachers use the QAR strategy in biology classes to enhance their analytical reasoning. Moreover, further research should explore the replication of this study in other grade levels and subjects using larger samples to determine broader effectiveness.

**Keywords**— QAR Strategy, Higher Order Thinking Skills (HOTS), Learners’ Engagement, Biology 2, Cognitive, Behavioral and Affective Engagement.

## I. INTRODUCTION

Emphasis on developing higher-order thinking skills has become a major focus in modern science education. This corresponds to preparing the students to play a role in a society that is increasingly dependent on science and technology. HOTS are considered to be very crucial thinking skills needed by teachers to train students to develop 21st century learning. This trend is due to changes in future job demands and increasingly complex societal needs. Job descriptions in science and technology increasingly require

individuals who could think critically, solve complex problems and adapt quickly. People are becoming more aware that higher-order thinking skills are essential for addressing global concerns like climate change, the energy catastrophe, and health. Therefore, the development of higher-order thinking is needed as a regular science teaching material in schools to introduce constructivist pedagogy elements into science classes (Yanti and Thohir, 2024).

The Second Congressional Commission on Education (EDCOM 2) revealed the results of the Early Language, Literacy and Numeracy Assessment (ELLNA) and National Achievement Test (NAT) conducted from 2023 to 2025 and found out that the percentage of proficient or highly proficient students dropped to 19.56% in Grade 6 based on the NAT, then plummeted further to 0.74% in Grade 10 and 0.40% in Grade 12 or the final year of senior high school (SHS). The 0.40% is equivalent to only 6,518 out of 1.6 million Grade 12 students, or just four in every 1,000. Proficiency at this stage, according to EDCOM 2, refers to being “skilled in solving problems, managing and communicating information, and analyzing and evaluating data to create or formulate ideas.” They also cited that many SHS graduates still require remediation in literacy, numeracy, and scientific reasoning when they enter higher education.

In line with this, it is important to have a focus on creating or proposing new teaching strategies that can help develop skills in scientific analysis and literacy. In addition to HOTS, learner engagement is also critically important in education because it directly affects students' motivation, achievement, and long-term success. Learners are more likely to participate in class when they are actively engaged and they will be able to understand concepts deeply, retain information and apply their learning in meaningful ways (Alamsyah, 2024).

Applying a new strategy in the classroom will have a huge impact on the students’ engagement and even on their thinking skills in Science Education including Biology. Biology is a foundational science subject that offers numerous opportunities for students to develop a deeper understanding of life processes, ecological relationships and relevance of science to people and environment. Many students continue to struggle with passive learning, rote memorization and limited comprehension of complex topics despite the importance of Biology to cultivate scientific literacy.

To address these issues, there is a need to implement teaching strategies that not only improve content mastery but also enhance learners' cognitive engagement, metacognition and critical thinking.

One such strategy is the Question-Answer Relationship (QAR), a research-based approach that guides students in understanding different types of questions and the corresponding methods to find answers whether from the text or through inference and analysis. The QAR strategy encourages a structured approach to questioning and reasoning which are the core components of HOTS by explicitly teaching students how to determine and answer between "Right There," "Think and Search," "Author and Me," and "On My Own" question types. Creating their own questions within those types can help them enhance their ability to analyze contents.

The study investigated the utilization of the QAR strategy in Biology 2 class and how it will affect both learners' engagement and Higher Order Thinking Skills (HOTS). It examined how this strategy can be able to promote in-depth inquiry and contribute to the development of 21st-century skills.

### *1.1 Statement of the Problem*

#### *Problem/s which were addressed by the research*

This study aimed to determine the effects of Question-Answer-Relationship (QAR) Strategy in the Students' Higher Order Thinking Skills and Learners' Engagement among STEM Students in Biology 2.

This study sought to answer the following questions:

1. What is the level of utilization of the Question-Answer-Relationship (QAR) Strategy in Biology 2 in terms of:
  - 1.1. Constructive Feedback;
  - 1.2. Use of Probing Questions;
  - 1.3. Instructional Modes;
  - 1.4. Real-life Connection; and
  - 1.5. Text Complexity?
2. What is the level of Learners' Engagement in Biology class while utilizing Question-Answer-Relationship (QAR) Strategy in terms of:
  - 2.1. Behavioral Engagement;
  - 2.2. Affective Engagement; and
  - 2.3. Cognitive Engagement?
3. What is the level of Learners' Higher Order Thinking Skills in terms of:
  - 3.1. Application of Knowledge;
  - 3.2 Analytical Reasoning;
  - 3.3. Critical Thinking;
  - 3.4. Evaluation; and
  - 3.5. Synthesis of Ideas?
4. Is there a significant relationship between the utilization of Question-Answer-Relationship (QAR) Strategy and Learners' Engagement in Biology 2 class?
5. Is there a significant effect in the utilization of Question-Answer-Relationship (QAR) Strategy in the Higher Order Thinking Skills of learners in Biology 2 class?

## II. METHODOLOGY

The research utilized researcher-made survey questionnaires and tests as instruments, while statistical analyses included mean, SD, frequency, percentage, Pearson correlation and regression analysis. The respondents of this study were Grade 11 students enrolled in the Academic Strand of the New Strengthened Curriculum for Senior High School at Similoan Integrated National High School. Specifically, the study involved two sections of students each consisting of approximately 50 students with a total of 100 respondents. These students were currently taking Biology 2 as part of their curriculum.

## III. RESULTS AND DISCUSSION

This part presents the presentation, analysis, and interpretation of data gathered to determine the effects of the Question-Answer-Relationship (QAR) Strategy on students' higher-order thinking skills and learners' engagement among STEM students in Biology 2. Specifically, this study examines the status of QAR Strategy utilization in terms of constructive feedback, use of probing questions, instructional modes, real-life connection, and text complexity. It also explores the level of learners' engagement in terms of behavioral, affective, and cognitive dimensions as well as the level of students' higher-order thinking skills including application of knowledge, analytical reasoning, critical thinking, evaluation, and synthesis of ideas.

Furthermore, this chapter investigates the significant relationship between the implementation of the QAR Strategy and learners' engagement and determines whether the use of this strategy has a significant effect on the higher-order thinking skills of students in Biology 2. This part discusses the findings of the study based on the statement of the problems.

### *Level of Utilization of the Question-Answer-Relationship (QAR) Strategy*

In this study, the status of the utilization of the Question-Answer-Relationship (QAR) Strategy refers to Constructive Feedback, Use of Probing Questions, Instructional Modes, Real-life Connection; and Text Complexity.

The level of utilization of the Question-Answer-Relationship (QAR) Strategy is revealed in the following table, which shows the statement, mean, standard deviation, remarks, and verbal interpretation.

Table 1 presents the level of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of constructive feedback.

Table 1 overall findings indicate that respondents strongly agree that constructive feedback is effectively practiced in the Biology 2 class. The results show that the teacher consistently provides clear and specific feedback on students' answers, which appears to be the most evident practice among the indicators. This is followed by feedback that helps learners identify both their strengths and areas for improvement as well as guidance that enables them to better understand how to improve their responses. Meanwhile, timely feedback that supports the application of higher-order thinking skills and encourages critical reflection is also observed, although to a

slightly lesser extent. The level of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Constructive Feedback attained a weighted mean score of 4.27 and a standard deviation of 0.64 and was verbally interpreted as Highly Utilized among the respondents. These findings suggest that constructive feedback is a well-established component of the QAR Strategy contributing to students' learning and development of thinking skills.

Table 1. Level of Utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Constructive Feedback

Statement	Mean	SD	Remarks
My teacher...			
...provides clear and specific feedback on my answers	4.43	0.61	Strongly Agree
...helps me understand how to improve my answers through his/her feedback	4.26	0.61	Strongly Agree
...gives timely feedback that guides me in applying higher-order thinking skills	4.18	0.63	Agree
...encourages me to reflect on my answers critically through his/her feedback	4.17	0.67	Agree
...helps me identify both my strengths and areas for improvement in Biology through his/her feedback	4.33	0.65	Strongly Agree
Weighted Mean	4.27		
SD	0.64		
Verbal Interpretation	Highly Utilized		

Table 2 presents the level of the utilization of the Question-Answer-Relationship (QAR) Strategy in terms of the use of probing questions.

Table 2. Level of Utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Use of Probing Questions

Statement	Mean	SD	Remarks
My teacher...			
...asks follow-up questions that prompt me for deeper thinking about the topic	4.32	0.62	Strongly Agree
...encourages clearer explanation of my answers through probing questions	4.48	0.59	Strongly Agree
...challenges me to analyze and evaluate information through questioning	4.31	0.61	Strongly Agree
...encourages me to justify my answers with evidence	4.36	0.56	Strongly Agree
...helps me connect different concepts in Biology through open-ended questions	4.34	0.57	Strongly Agree
Weighted Mean	4.36		
SD	0.59		
Verbal Interpretation	Highly Utilized		

The findings reveal that respondents strongly agree that probing questions are effectively employed in the Biology 2 class. Among the indicators, encouraging learners to provide clearer explanations of their answers emerges as the most evident practice. This is followed by prompting students to justify their responses with evidence and helping them connect different concepts in Biology through open-ended questions. Additionally, the teacher's use of follow-up questions to deepen students' thinking and the practice of challenging learners to analyze and evaluate information are also strongly observed.

The level of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Use of Probing Questions attained a weighted mean score of 4.36 and a standard deviation of 0.59 and is verbally interpreted as

Highly Utilized among the respondents. These results suggest that probing questions are consistently utilized as part of the QAR Strategy promoting deeper understanding and enhancing students' higher-order thinking skills.

Table 3 shows the level of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Instructional Modes.

In this context, the table presents the extent of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of instructional modes providing insight into how diverse teaching strategies contribute to the overall effectiveness of the approach.

Table 3. Level of Utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Instructional Modes

Statement	Mean	SD	Remarks
My teacher...			
...uses a variety of strategies (e.g., discussions, group work, visual aids) when applying QAR	4.67	0.49	Strongly Agree
...organizes instructional activities in a structured way to support the effective use of QAR	4.28	0.60	Strongly Agree
...facilitates understanding of complex questions through different modes of instruction	4.11	0.65	Agree
...maintains active student involvement during lessons	4.31	0.58	Strongly Agree
...provides engaging class activities that support QAR strategies	4.29	0.62	Strongly Agree
Weighted Mean	4.33		
SD	0.62		
Verbal Interpretation	Highly Utilized		

Table 3 indicates that respondents strongly agree that a variety of instructional strategies are effectively used in the Biology 2 class particularly in incorporating discussions, group work and visual aids when applying the QAR Strategy. This is followed by maintaining active student involvement during lessons, providing engaging class activities and organizing instructional tasks in a structured manner to support the effective implementation of the strategy. Furthermore, respondents agree that the use of different instructional modes helps facilitate their understanding of complex questions although this aspect is observed to a slightly lesser extent. Overall, the results suggest that diverse and well-structured instructional modes are consistently employed contributing to improved student engagement and comprehension.

The level of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Instructional Modes attained a weighted mean score of 4.33 and a standard deviation of 0.62 and is verbally interpreted as Highly Utilized among the respondents.

This implies that the utilization of the Question-Answer-Relationship (QAR) strategy in terms of instructional modes is highly evident, as respondents generally Strongly Agree that their teacher uses variety of instructional activities that made them understand complex topics and provides engaging class activities with QAR as the strategy employed.

Table 4 presents the level of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of real-life connections. This table provides a summary of the

respondents' perceptions regarding how the QAR strategy facilitates the application of learned concepts to real-life situations.

Table 4. Level of Utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Real-life Connection

Statement	Mean	SD	Remarks
My teacher...			
...connects the QAR lesson and articles to real-life situations	4.47	0.54	Strongly Agree
...uses real-world examples to help me understand biological concepts	4.39	0.60	Strongly Agree
...helps me relate what I learn in Biology to current events or environmental issues	4.20	0.59	Agree
...applies concepts to real situations to make lessons more meaningful	4.23	0.62	Strongly Agree
...motivates me to participate in class discussions through real-world connections	4.19	0.65	Agree
Weighted Mean	4.30		
SD	0.61		
Verbal Interpretation	Highly Utilized		

The findings indicate that respondents strongly agree that the teacher effectively connects lessons and reading materials to real-life situations, using real-world examples to enhance understanding of biological concepts and applying concepts to make lessons more meaningful. Additionally, respondents agree that the teacher helps them relate what they learn in Biology to current events or environmental issues and encourages participation in class discussions through these real-world connections. These results suggest that linking lessons to practical, real-life contexts is a key component of the QAR Strategy, fostering meaningful learning and active student engagement.

The level of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Real-life Connection attained a weighted mean score of 4.30 and a standard deviation of 0.61 and is verbally interpreted as Highly Utilized among the respondents.

This implies that the utilization of the Question-Answer-Relationship (QAR) strategy in terms of real-life connection is highly evident, as respondents generally Strongly Agree that their teacher motivates them to apply concepts to real situations or current events and helps them understand biological concepts more.

Table 5 presents the level of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of text complexity. This table shows how students perceive the strategy's effectiveness in helping them understand and analyze texts of varying difficulty levels. It further provides insight into how the strategy supports learners in navigating and comprehending increasingly complex biological texts.

Table 5 findings reveal that respondents strongly agree that the teacher provides reading materials and questions that are appropriately challenging, and promoting engagement with texts that require analysis, interpretation, and evaluation. The results also indicate that complex materials are used to encourage critical thinking and guide learners in effectively understanding intricate texts. Overall, these findings suggest that the QAR Strategy incorporates text complexity in a way

that fosters deeper cognitive processing and enhances students' higher-order thinking skills.

Table 5. Level of Utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Text Complexity

Statement	Mean	SD	Remarks
My teacher...			
...provides texts and questions that are appropriately challenging	4.39	0.65	Strongly Agree
...gives reading materials that encourage critical thinking	4.33	0.64	Strongly Agree
...requires me to analyze, interpret, and evaluate information in the texts	4.35	0.66	Strongly Agree
...supports the development of higher-order thinking skills through complex materials	4.34	0.61	Strongly Agree
...guides us in understanding complex texts effectively	4.30	0.59	Strongly Agree
Weighted Mean	4.34		
SD	0.63		
Verbal Interpretation	Highly Utilized		

The level of utilization of the Question-Answer-Relationship (QAR) Strategy in terms of Text Complexity attained a weighted mean score of 4.34 and a standard deviation of 0.63 and is verbally interpreted as Highly Utilized among the respondents.

This implies that the utilization of the Question-Answer-Relationship (QAR) strategy in terms of text complexity is highly evident, as respondents generally Strongly Agree that QAR supports the development of higher-order thinking skills through complex materials and provides texts and questions that are appropriately challenging to their level of understanding.

#### *Level of Learners' Engagement*

In this study, the level of Learners' Engagement in Biology 2 class is measured while utilizing Question-Answer-Relationship (QAR) Strategy referring to Behavioral Engagement, Affective Engagement, and Cognitive Engagement.

The level of Learners' Engagement in Biology 2 class while utilizing Question-Answer-Relationship (QAR) Strategy is shown in the following table, which shows the statement, mean, standard deviation, remarks, and verbal interpretation. By examining these results, the study aims to determine whether the strategy effectively enhances active participation, fosters positive learning attitudes and promotes deeper cognitive processing among learners.

Table 6 presents the level of Learners' Engagement in terms of Behavioral Engagement.

The level of learners' engagement in Biology 2 while utilizing the Question-Answer-Relationship (QAR) Strategy in terms of behavioral engagement indicates that respondents generally strongly agree that they are actively involved in the learning process. The findings show that learners feel a sense of pride when they correctly answer QAR questions or explain their reasoning which appears to be the most evident manifestation of engagement. They also strongly value the experience of applying QAR strategies as it helps them better understand and connect Biology concepts to real-life situations. In addition, students express genuine interest in

learning new concepts and enjoy QAR-based lessons as these make the subject more engaging and meaningful. However, respondents only moderately agree in terms of their confidence in providing answers and explanations during QAR activities suggesting that while engagement is high, some learners may still need support in building confidence when expressing their ideas. Overall, the results imply that the QAR Strategy effectively promotes behavioral engagement among students in Biology 2.

Table 6. Level of Learners' Engagement in terms of Behavioral Engagement

Statement	Mean	SD	Remarks
I can...			
...enjoy QAR-based lessons because the teacher makes learning Biology 2 topics more interesting	4.20	0.65	Strongly Agree
...be proud when I can answer QAR questions correctly or explain my reasoning in Biology 2 lessons	4.41	0.67	Strongly Agree
...be genuinely interested in learning new Biology 2 concepts through QAR strategy activities.	4.21	0.69	Strongly Agree
...be confident in providing answers and explanations during QAR activities in Biology 2 lessons	3.90	0.59	Moderately Agree
...value the experience of applying QAR strategies because it helps me understand and connect Biology 2 concepts to real-life situations	4.29	0.67	Strongly Agree
Weighted Mean	4.20		
SD	0.67		
Verbal Interpretation			High

The status of the level of Learners' Engagement in Biology 2 class while utilizing Question-Answer-Relationship (QAR) Strategy in terms of Behavioral Engagement attained a weighted mean score of 4.20 and a standard deviation of 0.67 and is verbally interpreted as High among the respondents.

This implies that the Question-Answer-Relationship (QAR) Strategy significantly enhances learners' behavioral engagement in Biology 2 as students demonstrate strong pride, interest and enjoyment in answering questions and in explaining their reasoning. It also inferred that while learners are generally engaged and motivated through QAR-based activities, there is still a need to further strengthen their confidence in providing explanations during class discussions.

Table 7 presents the level of Learners' Engagement in terms of Affective Engagement.

The level of learners' engagement in Biology 2 while utilizing the Question-Answer-Relationship (QAR) Strategy in terms of affective engagement indicates also that respondents generally strongly agree that they demonstrate positive attitudes toward the learning process. The findings show that learners are able to carefully follow the teacher's instructions during QAR activities which appear to be the most evident indicator. They also show strong agreement in their ability to work effectively with classmates, complete assigned tasks on time, and remain attentive and focused during discussions and activities. However, respondents only moderately agree in terms of their active participation in answering QAR questions and contributing to class discussions, suggesting that while students display positive feelings and attitudes toward

learning, some may still be hesitant to actively express their ideas. Overall, the results imply that the QAR Strategy fosters positive affective engagement among learners although further encouragement may enhance active participation.

Table 7. Level of Learners' Engagement in terms of Affective Engagement

Statement	Mean	SD	Remarks
I can...			
...actively participate in answering QAR questions during Biology 2 lessons and contribute to class discussions.	3.97	0.67	Moderately Agree
...complete all QAR exercises and assignments related to Biology 2 topics on time.	4.31	0.66	Strongly Agree
...carefully follow the teacher's instructions when performing QAR activities in Biology 2.	4.52	0.56	Strongly Agree
...work effectively with my classmates to solve QAR tasks and complete group activities in Biology 2.	4.33	0.62	Strongly Agree
...stay attentive and focused during QAR discussions and activities on Biology 2 concepts.	4.21	0.62	Strongly Agree
Weighted Mean		4.27	
SD		0.65	
Verbal Interpretation			Very High

The level of Learners' Engagement in Biology 2 class while utilizing Question-Answer-Relationship (QAR) Strategy in terms of Affective Engagement attained a weighted mean score of 4.27 and a standard deviation of 0.65 and is verbally interpreted as Very High among the respondents.

This implies that the use of the Question-Answer-Relationship (QAR) Strategy in Biology 2 promotes a high level of affective engagement as learners strongly agree that they can follow instructions, collaborate effectively, complete tasks on time and remain attentive during activities.

Table 8 presents the level of Learners' Engagement in terms of Cognitive Engagement. This table illustrates how actively students are involved in thinking, processing, and understanding the lesson content during the implementation of the QAR strategy. It further highlights the extent to which the strategy promotes higher-order thinking skills such as analysis, interpretation, and critical evaluation among learners.

Table 8. Level of Learners' Engagement in terms of Cognitive Engagement

Statement	Mean	SD	Remarks
I can...			
...carefully analyze Biology 2 texts and questions to provide accurate responses using the QAR strategy.	4.98	0.14	Strongly Agree
...apply critical thinking to interpret diagrams, charts, and information when answering Biology 2 QAR questions.	4.92	0.27	Strongly Agree
...reflect on my previous answers to improve my understanding of Biology 2 topics during QAR activities.	4.90	0.30	Strongly Agree
...connect concepts from different Biology 2 lessons to answer QAR questions more effectively.	4.89	0.31	Strongly Agree
...plan and use strategies to solve complex QAR questions in Biology 2 lessons.	4.96	0.20	Strongly Agree
Weighted Mean		4.93	
SD		0.26	
Verbal Interpretation			Very High

The level of learners' engagement in Biology 2 while utilizing the Question-Answer-Relationship (QAR) Strategy in terms of cognitive engagement indicates that respondents strongly agree that they actively use higher-level thinking processes during learning activities. The findings reveal that learners carefully analyze texts and questions to provide accurate responses using QAR Strategy which appears to be the most evident indicator. They also demonstrate strong agreement in planning and using strategies to solve complex questions, applying critical thinking in interpreting diagrams and other forms of information, reflecting on previous answers to improve understanding and connecting concepts from different lessons to respond more effectively. These results suggest that the QAR Strategy significantly promotes cognitive engagement by encouraging learners to think deeply, process information critically and apply knowledge across different contexts.

The status of the level of Learners' Engagement in Biology 2 class while utilizing Question-Answer-Relationship (QAR) Strategy in terms of Cognitive Engagement attained a weighted mean score of 4.93 and a standard deviation of 0.26 and is verbally interpreted as Very High among the respondents.

This implies that the QAR strategy effectively promotes strong cognitive engagement among students evidenced by the highly engaged rating indicating that learners are deeply involved in understanding, processing and applying Biology 2 concepts during classroom activities.

*Level of Learners' Higher Order Thinking Skills*

In this study, the level of Learners' Higher Order Thinking Skills refers to Application of Knowledge, Analytical Reasoning, Critical Thinking, Evaluation and Synthesis of Ideas.

The level of Learners' Higher Order Thinking Skills is shown in the following table, which shows the mean, standard deviation, and verbal interpretation.

Table 9 presents the level of Learners' Higher Order Thinking Skills in terms of Application of Knowledge.

Table 9. Level of Learners' Higher Order Thinking Skills in terms of Application of Knowledge

Range of Scores	Frequency (f)	Percentage (%)	Descriptive Equivalent
9 - 10	53	53 %	Outstanding
7 - 8	24	24 %	Very Satisfactory
5 - 6	20	20 %	Satisfactory
3 - 4	3	3 %	Fair
1 - 2	0	0 %	Needs Improvement
N = 100			Very Satisfactory
Mean			7.87
SD			1.72
Descriptive Equivalent			Very Satisfactory

Table 9 presents the level of learners' higher-order thinking skills (HOTS) in terms of application of knowledge. The results show that the majority of respondents, fifty-three percent 53% (f=53) scored in the highest bracket of 9–10 demonstrating strong ability to apply their knowledge in Biology 2 lessons. This is followed by 24% (f=24)

respondents who scored in the 7–8 bracket. Twenty respondents representing 20% achieved scores in the 5–6 range, while only 3% (f=3) scored in the 3–4 bracket. Notably, no respondents scored in the lowest bracket of 1–2.

Overall, the mean score of 7.87 interpreted as "Very Satisfactory," indicates that the QAR Strategy effectively enhances students' ability to apply concepts learned in class. The standard deviation of 1.72 further suggests that learners' performance in this aspect is relatively consistent reflecting a homogeneous level of skill development among the students. The high scores achieved by most students in the application of knowledge indicate that learners can effectively transfer the concepts learned in Biology 2 to practical situations. This suggests that the QAR Strategy not only reinforces comprehension but also boosts students' confidence in applying learned concepts. Moreover, the result demonstrates that the strategy successfully fosters higher-order thinking by challenging learners to move beyond memorization toward meaningful application.

Table 10 presents the level of Learners' Higher Order Thinking Skills in terms of Analytical Reasoning. This table illustrates the extent to which students demonstrate their ability to examine information, identify relationships and draw logical conclusions during the learning process. It further reflects how effectively learners apply critical thinking skills in analyzing complex biological concepts and solving problems.

Table 10. Level of Learners' Higher Order Thinking Skills in terms of Analytical Reasoning

Range of Scores	Frequency (f)	Percentage (%)	Descriptive Equivalent
9 - 10	52	52 %	Outstanding
7 - 8	28	28 %	Very Satisfactory
5 - 6	20	20 %	Satisfactory
3 - 4	0	0 %	Fair
1 - 2	0	0 %	Needs Improvement
N = 100			100%
Mean			8.04
SD			1.69
Descriptive Equivalent			Very Satisfactory

Table 10 presents the level of learners' higher-order thinking skills (HOTS) in terms of analytical reasoning. The results reveal that the majority of respondents, fifty-two percent (52%) or (f = 52), scored in the highest bracket of 9–10, indicating a strong ability to analyze and process information in Biology 2 lessons. This is followed by twenty-eight percent (28%) or (f = 28) of the respondents who fell within the 7–8 bracket. Meanwhile, twenty percent (20%) or (f = 20) obtained scores in the 5–6 range. Notably, no respondents were recorded in the lower brackets of 3–4 and 1–2.

It can be gleaned from table 12 that the Level of Learners' Higher Order Thinking Skills in terms of Analytical Reasoning is 8.04 with "Very Satisfactory" as verbal interpretation.

The standard deviation of 1.69 indicates that the Level of Learners' Higher Order Thinking Skills in terms of Analytical Reasoning is homogeneous.

The high concentration of students in the upper score brackets implies that learners can examine information critically, identify relationships among concepts and draw logical conclusions. This suggests that the QAR Strategy not only strengthens students' ability to analyze biological concepts but also promotes deeper understanding through structured questioning. Moreover, the findings indicate that the strategy effectively develops higher-order thinking by encouraging learners to engage in reasoning processes that go beyond basic comprehension.

Table 11 presents the level of Learners' Higher Order Thinking Skills in terms of Critical Thinking.

Table 11. Level of Learners' Higher Order Thinking Skills in terms of Critical Thinking

Range of Scores	Frequency (f)	Percentage (%)	Descriptive Equivalent
9 - 10	31	31 %	Outstanding
7 - 8	33	33 %	Very Satisfactory
5 - 6	24	24 %	Satisfactory
3 - 4	12	12 %	Fair
1 - 2	0	0 %	Needs Improvement
N = 100 100%			
Mean			6.88
SD			1.84
Descriptive Equivalent			Very Satisfactory

In Table 11, the results reveal that the majority of respondents, thirty-three percent (33%) or (f = 33), scored in the 7–8 bracket, indicating a strong level of critical thinking among learners. This is followed by thirty-one percent (31%) or (f = 31) of the respondents who attained scores in the highest bracket of 9–10. Meanwhile, twenty-four percent (24%) or (f = 24) obtained scores in the 5–6 range, while twelve percent (12%) or (f = 12) were in the 3–4 bracket. Notably, no respondents were recorded in the lowest bracket of 1–2.

It can be gleaned from Table 13 that the Level of Learners' Higher Order Thinking Skills in terms of Critical Thinking is 6.88 with "Very Satisfactory" as verbal interpretation. The standard deviation of 1.84 indicates that the Level of Learners' Higher Order Thinking Skills in terms of Critical Thinking is homogeneous.

The distribution of scores suggests that most students can evaluate information, form judgments and make reasoned decisions in Biology 2 lessons. The absence of scores in the lowest bracket further highlights that all learners possess at least a basic level of critical thinking ability. Moreover, the findings demonstrate that QAR strategy supports the development of higher-order thinking by promoting thoughtful evaluation and informed decision-making among learners.

Table 12 presents the level of Learners' Higher Order Thinking Skills in terms of Evaluation.

In table 14, the results reveal that the majority of respondents, fifty-four percent (54%) or (f = 54) scored in the highest bracket of 9–10 indicating a strong ability to evaluate information in Biology 2 lessons. This is followed by twenty-five percent (25%) or (f = 25) of the respondents who fell within the 7–8 bracket. Meanwhile, nineteen percent (19%) or (f = 19) obtained scores in the 5–6 range, while only two

percent (2%) or (f = 2) were in the 3–4 bracket. Notably, no respondents were recorded in the lowest bracket of 1–2.

Table 12. Level of Learners' Higher Order Thinking Skills in terms of Evaluation

Range of Scores	Frequency (f)	Percentage (%)	Descriptive Equivalent
9 - 10	54	54 %	Outstanding
7 - 8	25	25 %	Very Satisfactory
5 - 6	19	19 %	Satisfactory
3 - 4	2	2 %	Fair
1 - 2	0	0 %	Needs Improvement
100 100%			
Mean			8.14
SD			1.60
Descriptive Equivalent			Very Satisfactory

It can be gleaned from table 14 that the Level of Learners' Higher Order Thinking Skills in terms of Evaluation is 8.14 with "Very Satisfactory" as Verbal Interpretation.

The standard deviation of 1.60 indicates that the Level of Learners' Higher Order Thinking Skills in terms of Evaluation is homogeneous.

The high number of students in the upper score brackets implies that learners can critically assess ideas, compare alternatives and justify their conclusions effectively. This suggests that the Question-Answer-Relationship (QAR) Strategy significantly contributes to the development of evaluation skills by encouraging students to examine information critically and make reasoned judgments. Moreover, the findings highlight that the strategy enhances higher-order thinking by promoting sound decision-making among learners.

Table 13 presents the level of Learners' Higher Order Thinking Skills in terms of Synthesis of Ideas.

Table 13. Level of Learners' Higher Order Thinking Skills in terms of Synthesis of Ideas.

Range of Scores	Frequency (f)	Percentage (%)	Descriptive Equivalent
9 - 10	39	39 %	Outstanding
7 - 8	34	34 %	Very Satisfactory
5 - 6	22	22 %	Satisfactory
3 - 4	5	5 %	Fair
1 - 2	0	0 %	Needs Improvement
100 100%			
Mean			7.53
SD			1.81
Descriptive Equivalent			Very Satisfactory

In Table 13, it was found that most of the respondents belong to bracket 9-10, which is represented by thirty-nine (39) or thirty-nine percent (39%) followed by scores that belong to bracket 7-8, which is represented by thirty-four (34) or thirty-four percent (34%). Next are the respondents that belong to the score bracket of 5-6 that comprises of twenty-two (22) or twenty-two percent (22%) and 3-4 comprising five (5) or five percent (5%). Notably, it also depicts that there were no one (0) or zero percent (0 %) who got a score of 1-2.

It can be gleaned from table 15 that the Level of Learners' Higher Order Thinking Skills in terms of Synthesis of Ideas is 7.53 with "Very Satisfactory" as Verbal Interpretation.

The standard deviation of 1.81 indicates that the Level of Learners' Higher Order Thinking Skills in terms of Synthesis of Ideas is homogeneous.

The distribution of scores suggests that most students can combine information from different concepts, form coherent explanations and generate new insights. The absence of scores in the lowest bracket further indicates that all learners possess at least a basic ability to synthesize knowledge. This suggests that the Question-Answer-Relationship (QAR) Strategy plays a significant role in developing synthesis skills by encouraging learners to connect concepts, generate meaningful responses and construct new understanding.

*Significant Relationship between the Implementation of Question-Answer-Relationship (QAR) Strategy and Learners' Engagement in Biology 2 Class*

In this study, the significant relationship between the implementation of Question-Answer-Relationship (QAR) Strategy and Learners' Engagement in Biology 2 Class is examined. The implementation of the QAR strategy in this study is examined in terms of constructive feedback, use of probing questions, instructional mode, real-life application, and text complexity. Furthermore, this section provides a detailed presentation of the data gathered from the respondents including the analysis and interpretation of results based on the identified variables. The level of Learners' Engagement in Biology 2 class is analyzed across the dimensions of behavioral which refers to students' participation in classroom activities, affective which relates to their interest toward the lesson and cognitive engagement which involves their level of investment in understanding lessons in different complexity. In addition, this section discusses the trends observed in the responses of the learners which focused on how the different components of the QAR strategy relate to their level of engagement. The results are presented using appropriate statistical tools to determine the presence of significant relationships between variables.

Table 14 shows the Significant Relationship between the Utilization of Question-Answer-Relationship (QAR) Strategy and Learners' Engagement in Biology 2 Class.

Table 14 reveals that constructive feedback has a statistically significant relationship with learners' engagement in Biology 2 class. Constructive feedback showed a moderate positive relationship with behavioral engagement ( $r = 0.627, p = 0.000$ ), indicating that higher levels of constructive feedback are associated with increased behavioral engagement among learners. Similarly, a moderate positive relationship was found between constructive feedback and affective engagement ( $r = 0.631, p = 0.000$ ). This suggests that as constructive feedback increases, learners' affective engagement also tends moderately increase. In terms of cognitive engagement, constructive feedback demonstrated a moderate positive relationship ( $r = 0.546, p = 0.000$ ), implying that greater implementation of constructive feedback is linked to higher cognitive engagement. Overall, this indicates that constructive feedback is significantly related to behavioral, affective, and cognitive engagement in Biology 2 class.

Table 14. Significant Relationship between the Utilization of Question-Answer-Relationship (QAR) Strategy and Learners' Engagement in Biology 2 Class

Implementation of Relationship (QAR) Strategy	Question-Answer-Relationship (QAR) Strategy	Learners' Engagement		
		Behavioral	Affective	Cognitive
Constructive Feedback	Pearson Correlation	0.627*	0.631*	0.546*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	100	100	100
Use of Probing Questions	Pearson Correlation	0.595*	0.610*	0.616*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	100	100	100
Instructional Modes	Pearson Correlation	0.458*	0.485*	0.385*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	100	100	100
Real-life Connection	Pearson Correlation	0.559*	0.479*	0.490*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	100	100	100
Text Complexity	Pearson Correlation	0.511*	0.627*	0.533*
	Sig. (2-tailed)	0.000	0.000	0.000
	N	100	100	100

Similarly, Use of Probing Questions showed a moderate positive relationship with behavioral engagement ( $r = 0.595, p = 0.000$ ), indicating that higher levels of use of probing questions are associated with increased behavioral engagement among learners. A similar pattern emerged for affective engagement. A moderate positive relationship was found between use of probing questions and affective engagement ( $r = 0.610, p = 0.000$ ). This suggests that as use of probing questions increases, learners' affective engagement also tends to moderately increase. In terms of cognitive engagement, use of probing questions demonstrated a moderate positive relationship ( $r = 0.616, p = 0.000$ ), implying that greater implementation of use of probing questions is linked to higher cognitive engagement. Overall, this indicates that use of probing questions is significantly related to behavioral, affective, and cognitive engagement in Biology 2 class.

In addition, a moderate positive correlation was found between instructional mode and behavioral engagement ( $r = 0.458$ ), suggesting that the way QAR is delivered influences students' participation and good behavior in class. In relation to affective engagement, the analysis also revealed a moderate positive relationship ( $r = 0.485$ ). This implies that the QAR contributes to students' interest, motivation, and emotional connection to the learning process. Meanwhile, cognitive engagement showed a positive but comparatively lower correlation ( $r = 0.385$ ). Although weaker than the other two components, this still indicates that instructional mode plays a meaningful role in promoting students' understanding concepts and applying higher-order thinking skills.

Additionally, the findings show that a moderate positive correlation between real-life connection and behavioral engagement ( $r = 0.559$ ), indicating that linking QAR articles encourages greater participation and promotes appropriate classroom behavior. When learners see the relevance of the content to their own lives, they are more likely to be actively involved in classroom activities. In terms of affective engagement, the results demonstrated a moderate positive

relationship ( $r = 0.479$ ) too. This suggests that incorporating real-life connections helps strengthen students' interest, enthusiasm, and emotional investment in the learning process, making lessons more meaningful and relatable. For cognitive engagement, a moderate positive correlation was also observed ( $r = 0.490$ ). This implies that connecting instruction to real-world contexts supports students in enhancing their understanding, critical thinking, and applying concepts more effectively promoting more thoughtful and purposeful learning.

Moreover, the results indicated a moderate positive correlation between text complexity of QAR and behavioral engagement ( $r = 0.511$ ). It shows that when the level of text difficulty is thoughtfully aligned with QAR strategies, students are more likely to remain attentive, participate actively, and demonstrate appropriate classroom behavior. In relation to affective engagement, a positive relationship was found ( $r = 0.627$ ). This implies that appropriate text complexity significantly enhances students' interest, motivation, and emotional involvement in learning, making them more enthusiastic in the lesson. Similarly, cognitive engagement showed a moderate positive correlation ( $r = 0.533$ ). This finding indicates that integrating appropriate text complexity supports deeper thinking and encourages students to apply higher-order thinking skills in their academic tasks.

*Significant Effect between the Utilization of Question-Answer-Relationship (QAR) Strategy and Learners' Higher Order Thinking Skills in Biology 2 Class*

In this study, the significant effect between the utilization of Question-Answer-Relationship (QAR) Strategy and Learners' Higher Order Thinking Skills (HOTS) in Biology 2 Class is assessed. The implementation of the QAR strategy in this study is examined in terms of constructive feedback, use of probing questions, instructional mode, real-life application, and text complexity. The level of Higher Order Thinking Skills (HOTS) in Biology 2 is analyzed across the dimensions of Application of Knowledge, Analytical Reasoning, Critical Thinking, Evaluation and Synthesis of Ideas. The analysis aims to determine how effectively the QAR strategy enhances students' higher-order thinking and the contribution of its components.

Table 15 shows the Significant Effect in the Utilization of Question-Answer-Relationship (QAR) Strategy in Learners' Higher Order Thinking Skills in Biology 2 Class.

Firstly, Table 15 presents the significant effect of Constructive Feedback of QAR on the different dimensions of students' higher-order thinking skills (HOTS). The computed t-values were compared with the critical value of 1.98 at the 0.05 level of significance. The results revealed that Application of Knowledge obtained a t-value of 5.473, Analytical Reasoning obtained 6.061, Critical Thinking obtained 5.194, Evaluation obtained 5.429 and Synthesis of Ideas obtained 6.659. All computed t-values are greater than the critical value of 1.98, and all obtained a significance value of 0.000, which is less than 0.05. Therefore, the null hypotheses are rejected, indicating that constructive feedback

under QAR has a statistically significant effect on all dimensions of students' higher-order thinking skills.

Table 15. Significant Effect between the Utilization of Question-Answer-Relationship (QAR) Strategy and Learners' Higher Order Thinking Skills in Biology 2

Implementation of Learners' Higher Order Thinking Skills (HOTS)						
Question-Answer-Relationship Strategy	(QAR) Application of Knowledge	Analytical Reasoning	Critical Thinking	Evaluation	Synthesis of Ideas	
Constructive Feedback	t-value	5.473*	6.061*	5.194*	5.429*	6.659*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	100	100	100	100	100
Use of Probing Questions	t-value	6.116*	7.270*	4.750*	4.848*	5.886*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	100	100	100	100	100
Instructional Modes	t-value	6.064*	5.624*	4.381*	5.084*	4.103*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	100	100	100	100	100
Real-life Connection	t-value	6.190*	5.459*	4.551*	3.987*	4.886*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	100	100	0	100	100
Text Complexity	t-value	6.819*	7.870*	6.155*	5.359*	5.646*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000
	N	100	0	0	100	100

Furthermore, it also presents the significant effect of Use of Probing Questions of QAR on the different dimensions of students' higher-order thinking skills (HOTS). The computed t-values were also compared with the critical value of 1.98 at the 0.05 level of significance. The results revealed that Application of Knowledge obtained a t-value of 6.116, Analytical Reasoning obtained 7.270, Critical Thinking obtained 4.750, Evaluation obtained 4.848 and Synthesis of Ideas obtained 5.886. All computed t-values are greater than the critical value of 1.98, and all obtained a significance value of 0.000, which is less than 0.05. Therefore, the use of probing questions under QAR has a statistically significant effect on all dimensions of students' higher-order thinking skills.

In addition, Table 15 presents the significant effect of the Instructional Mode of QAR on the different dimensions of students' HOTS. The results revealed that Application of Knowledge obtained a t-value of 6.064, Analytical Reasoning obtained 5.624, Critical Thinking obtained 4.381, Evaluation obtained 5.084, and Synthesis of Ideas obtained 4.103. All computed t-values are greater than the critical value of 1.98 and all obtained a significance value of 0.000, which is less than 0.05 indicating statistical significance. Therefore, the null

hypothesis is rejected which means that the instructional mode of QAR has a statistically significant effect on all dimensions of students' higher-order thinking skills.

Moreover, Table 15 shows the significant effect of the Real-life Connection of QAR on the different dimensions of students' HOTS. The results reveal that Application of Knowledge obtained a t-value of 6.190, Analytical Reasoning obtained 5.459, Critical Thinking obtained 4.551, Evaluation obtained 3.987, and Synthesis of Ideas obtained 4.886. All computed t-values are greater than the critical value of 1.98 and all obtained a significant value of 0.000, which is less than 0.05. indicating statistical significance. Therefore, the null hypotheses are rejected, which means that the real-life connection of QAR has a statistically significant effect on all dimensions of students' higher-order thinking skills.

Lastly, Table 15 presents the significant effect of the Text Complexity of QAR on the different dimensions of students' HOTS. The results show that Application of Knowledge obtained a t-value of 6.819, Analytical Reasoning obtained 7.870, Critical Thinking obtained 6.155, Evaluation obtained 5.359, and Synthesis of Ideas obtained 5.646. All computed t-values are greater than the critical value of 1.98 and all obtained a significant value of 0.000, which is less than 0.05. indicating statistical significance. Therefore, the null hypotheses are rejected, which means that the text complexity of QAR has a statistically significant effect on all dimensions of students' higher-order thinking skills.

#### IV. CONCLUSION AND RECOMMENDATIONS

There is a significant relationship between the level of utilization of Question-Answer-Relationship (QAR) Strategy and Learners' Engagement in Biology 2 class. Thus, the null hypothesis is rejected. This means that the meaningful association between QAR implementation and learners' engagement suggests that structured questioning techniques play a vital role in strengthening students' overall involvement in learning.

There is a significant effect in the level of utilization of Question-Answer-Relationship (QAR) Strategy in the Higher Order Thinking Skills of learners in Biology 2 class. Thus, the

null hypothesis is rejected. This indicates that the QAR Strategy affirms its effectiveness as a powerful instructional tool for promoting advanced cognitive development in Biology 2.

Based on the results and conclusions of the study, the following recommendations are offered.

The Biology curriculum may consider incorporating QAR strategies as a recommended teaching approach to strengthen students' HOTS across other Biology topics or science subjects.

Biology teachers may consistently use the Question-Answer-Relationship (QAR) strategy emphasizing constructive feedback, probing questions, and instructional modes to foster higher-order thinking skills and student engagement. Teachers may integrate QAR activities into other topics in Biology to help students apply knowledge, analyze, evaluate, and synthesize information more effectively.

Future studies may replicate this research in other grade levels, other subjects, or larger samples to determine the broader effectiveness of QAR on HOTS and engagement. Researchers can explore combining QAR with other instructional strategies to see if the impact on HOTS and engagement can be further enhanced.

Students may actively participate in QAR-guided discussions, reflect on feedback, and practice answering probing questions to further develop critical thinking, analytical reasoning, and problem-solving skills.

Teachers may utilize QAR-based assessments to measure not just recall but application, analysis, evaluation, and synthesis skills aligning grading with HOTS development.

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