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Evolution acceptance framing and misconception resistance

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Abstract

This study investigates the effect of evolution acceptance framing on misconception resistance among Grade 12 students. Evolution is a fundamental concept in biology, yet it remains difficult for many learners due to persistent misconceptions and preexisting beliefs. Using a descriptive quantitative design, the study involved two groups: an experimental group exposed to acceptance framing and a control group receiving traditional instruction. Data were collected through pretest and post-test using validated instruments measuring evolution acceptance and misconceptions. Findings revealed that students initially demonstrated a high level of misconceptions. However, demographic variables such as sex, age, and academic strand showed no significant influence on misconception levels. The results suggest that misconceptions are consistently present across learners regardless of profile. The study highlights the importance of using supportive and non-confrontational teaching strategies to promote conceptual change, improve understanding, and reduce resistance to learning evolution in science education.

Keywords: Evolution Education; Misconception Resistance; Evolution Acceptance; Acceptance Framing; Science Education; Conceptual Change

1. Introduction

Evolution is a fundamental concept in biology that explains the diversity of life and how organisms change over time. It provides a scientific explanation for the origin of species, adaptation, and the relationships among living organisms. Understanding evolution is essential for students because it serves as the foundation for many biological concepts such as genetics, biodiversity, ecology, and environmental science. Despite its importance, evolution remains one of the most challenging and controversial topics in science education.

Many students enter the classroom with preexisting beliefs and misconceptions about evolution. These misconceptions may include the idea that humans evolved directly from monkeys, evolution is just a theory without evidence, or that evolution contradicts personal beliefs and values. Such misconceptions often result in resistance to learning and difficulty in accepting scientific explanations. These challenges can hinder students' understanding and negatively affect their scientific literacy.

One approach to addressing this issue is the use of evolution acceptance framing. Acceptance framing is a teaching strategy that presents evolution in a respectful and inclusive manner. It acknowledges students' beliefs while emphasizing scientific explanations and evidence. Instead of creating conflict, acceptance framing encourages students to view evolution as a scientific explanation that can coexist with personal perspectives. This strategy aims to reduce students' resistance and create a supportive learning environment that promotes understanding.

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Research suggests that when students feel respected and understood, they are more open to learning complex and sensitive scientific topics. Acceptance framing may help students reconsider their misconceptions and develop a more accurate understanding of evolution. By presenting evolution in a non-confrontational manner, teachers can encourage critical thinking, improve engagement, and foster positive attitudes toward science learning.

Therefore, this study aims to determine the effect of evolution acceptance framing on misconception resistance among Grade 12 students. Specifically, it seeks to examine whether acceptance framing can improve students' acceptance of evolution and reduce misconceptions. The findings of this study may contribute to improved teaching strategies and help educators address challenges in teaching evolution effectively.

1.1. Statement of the Problem

This study aims to determine the level of misconception resistance among Grade 12 students.

Specifically, it seeks to answer the following questions:

- How may the respondents profile be describe in terms of:
  - Age
    - Sex
    - Academic Strand
- How may the level of students' misconceptions about evolution before the intervention be describe in terms of?
  - Very High Misconception
  - High Misconception
  - Low Misconception
  - Very Low Misconception
- Is there a significant difference between the respondent profile and misconception in evolution before the intervention?

1.2. Theoretical Framework

This study is anchored on the Constructivist Learning Theory, Conceptual Change Theory, and Cognitive Dissonance Theory.

Constructivist Learning Theory states that learners actively construct knowledge based on prior experiences and beliefs. Students enter the classroom with pre-existing ideas about evolution, which may either support or hinder learning. Through acceptance framing, teachers can help students reconstruct their understanding based on scientific evidence.

Conceptual Change Theory explains that students replace misconceptions with scientific concepts when they become dissatisfied with their prior knowledge. Acceptance framing helps students become open to conceptual change by reducing emotional resistance.

Cognitive Dissonance Theory explains that individuals experience discomfort when confronted with information that contradicts their beliefs. Acceptance framing minimizes cognitive dissonance by presenting evolution in a respectful and non-confrontational manner.

1.3. Conceptual Framework

This study follows an experimental research design with independent and dependent variables.

Independent Variable: Evolution Acceptance Framing Strategy

1.3.1. Dependent Variables:

- Evolution Acceptance
- Misconception Resistance

1.3.2. Control Variables:

- Grade level

- Learning competencies
- Instructional time

The intervention using evolution acceptance framing is expected to increase evolution acceptance and reduce misconceptions among Grade 12 students.

1.4. Research Paradigm

This study follows the Input–Process–Output (IPO) Model.

Input

- Students' prior acceptance of evolution
- Students' misconceptions about evolution
- Learning competencies on evolution
- Instructional materials

Process

- Pretest administration
- Implementation of Evolution Acceptance Framing
- Traditional instruction for control group
- Classroom discussion and activities
- Posttest administration

Output

- Improved evolution acceptance
- Reduced misconceptions about evolution
- Significant difference between control and experimental groups

Research paradigm flowchart on evolution framing

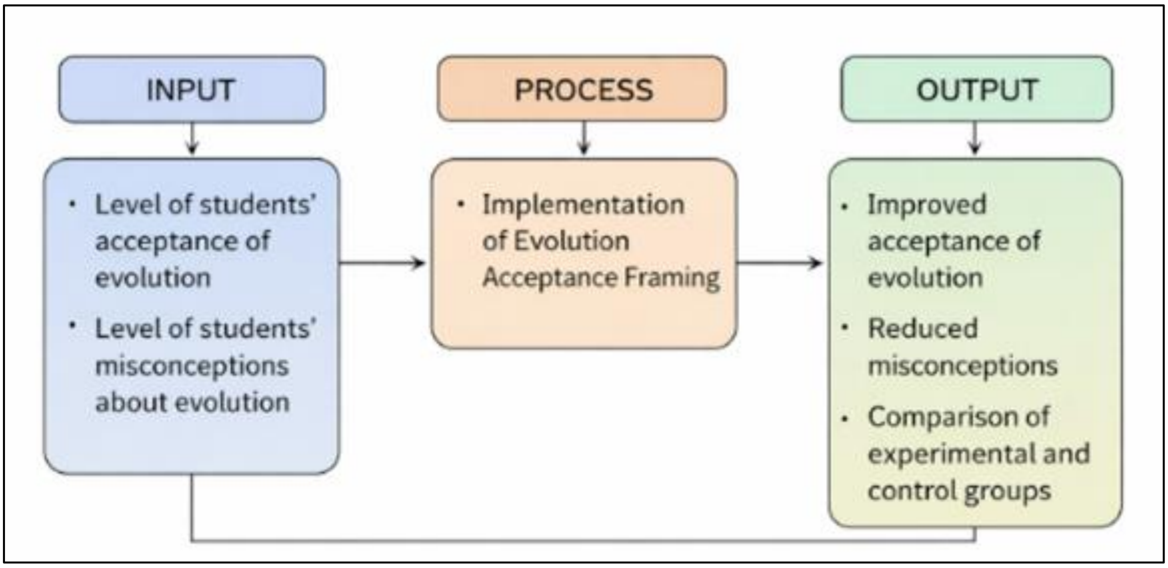

Figure 1 Research Paradigm

1.5. Hypotheses of the Study

The following null hypotheses will be tested at 0.05 level of significance:

1. There is no significant difference in students' evolution acceptance before the intervention.
2. There is no significant reduction in students' misconceptions after the intervention.
3. There is no significant difference between the control and experimental groups.

1.6. Significance the Study

This study is significant as it seeks to improve students' understanding of evolution by addressing misconceptions and increasing acceptance through evolution acceptance framing. The findings of this study will benefit various stakeholders in education.

Students. The results of this study will help students develop a clearer understanding of evolution concepts. By reducing misconceptions and improving acceptance, learners will be able to better grasp biological principles and scientific explanations. This may also improve their academic performance in science subjects, particularly biology.

Teachers. This research will provide teachers with an effective instructional strategy for teaching evolution. Teachers often face challenges when discussing evolution due to students' preconceived beliefs and misconceptions. The use of evolution acceptance framing may help teachers create a more supportive and respectful learning environment that encourages critical thinking and conceptual change.

School Administrators. The findings of this study may assist school administrators in promoting effective science teaching strategies. The results may also support professional development programs that focus on addressing misconceptions in science education.

Curriculum Developers. This research may contribute to the development of instructional materials and teaching guides that incorporate acceptance framing strategies. Curriculum developers may use the findings to strengthen evolution-related lessons and improve students' conceptual understanding.

Parents. The study may help parents understand the importance of scientific literacy and acceptance of evolution. This may encourage supportive learning environments at home that promote scientific inquiry and critical thinking.

Future Researchers. This study may serve as a reference for future researchers who wish to conduct similar studies related to evolution acceptance, misconception resistance, and science education strategies. It may also open opportunities for further research in different grade levels and subject areas.

1.7. Scope and Delimitation

This study focuses on determining the effect of evolution acceptance framing on misconception resistance among Grade 12 students. The research will be conducted among selected Grade 12 students enrolled during the academic year 2025–2026. The participants will be divided into two groups: experimental group and control group.

The study will utilize validated research instruments such as Evolution Acceptance Questionnaire and Misconception Test. The data gathered will be analyzed using appropriate statistical tools to determine significant differences between groups.

This research is limited to Grade 12 students in selected school only; therefore, the findings may not be generalized to all students in other schools or regions. The duration of the intervention is limited to the evolution lesson period, which may also affect the results of the study.

Furthermore, the study focuses only on evolution acceptance and misconceptions, and does not include other factors such as students' religious beliefs, socio-economic background, or prior academic achievement which may also influence acceptance of evolution. Despite these limitations, the study aims to provide valuable insights into improving evolution instruction and reducing misconceptions among learners.

1.8. Definition of Terms

This study focuses on Grade 12 students enrolled during the academic year 2025–2026. The research investigates the effect of evolution acceptance framing on misconception resistance. The study uses pretest and posttest instruments to measure evolution acceptance and misconceptions.

The research is limited to selected Grade 12 students and may not be generalized to all learners. The duration of the intervention is limited to the evolution unit.

- **Evolution Acceptance Framing** – A teaching strategy designed to present the concept of evolution in a supportive and non-confrontational manner. It emphasizes showing the scientific evidence for evolution while acknowledging students' personal beliefs and perspectives. This strategy aims to reduce resistance, increase openness to learning, and facilitate a deeper understanding of biological processes.

- **Misconception Resistance** – The extent to which students retain incorrect or inaccurate beliefs about evolution, even after receiving instruction. Misconception resistance indicates how strongly prior misunderstandings, cultural beliefs, or intuitive ideas interfere with students' ability to accept scientifically accurate concepts. Reducing misconception resistance is crucial for meaningful learning and conceptual change.
- **Evolution Acceptance** – Students' willingness to acknowledge and accept evolution as a scientifically valid explanation for the diversity and adaptation of living organisms over time. Evolution acceptance involves understanding key mechanisms such as natural selection, genetic variation, and adaptation, and recognizing evolution as a theory supported by extensive scientific evidence rather than a mere opinion or belief.
- **Control Group** – The group of students who receive traditional instruction on evolution, without the use of acceptance framing strategies. This group serves as a baseline to compare the effects of the intervention, allowing researchers to measure whether evolution acceptance framing has a significant impact on students' understanding and misconceptions.
- **Experimental Group** – The group of students exposed to the evolution acceptance framing intervention. This group participates in classroom activities, discussions, and instructional approaches that emphasize acceptance framing, aiming to increase evolution acceptance and reduce misconceptions. Comparison between this group and the control group allows researchers to evaluate the effectiveness of the intervention.
- **Conceptual Change** – The process through which students replace misconceptions or incomplete understanding with scientifically accurate concepts. Conceptual change is a critical goal of evolution education, and strategies like acceptance framing are designed to facilitate this process in a respectful and effective manner.

Instructional Materials – Resources such as textbooks, worksheets, visual aids, and multimedia used in teaching evolution. In this study, instructional materials are designed to support either traditional instruction or evolution acceptance framing interventions, ensuring consistency in content delivery while varying the approach to teaching.

2. Review of related literature and studies

2.1. Related Literature

Research in science education consistently highlights that evolution remains a challenging topic for students, largely due to deeply held misconceptions and varying levels of acceptance. Studies over the past decade emphasize both the persistence of misconceptions and the impact of instructional strategies designed to address these challenges.

A number of recent empirical studies indicate that even after formal instruction, many students retain misconceptions about evolution. For example, research by Aini and colleagues (2024) found that among university students, misconceptions such as associating evolution only with Darwin, the misunderstanding that individuals evolve rather than populations, or the idea that evolution implies perfecting organisms persisted even after taking an evolution course; although the group that completed the course had fewer misconceptions than those who did not, misunderstandings remained significant.

In another study focusing on educational interventions, Johnston et al. (2022) reported that an inquiry-based laboratory curriculum improved understanding of evolution more effectively than traditional, instructor-centered courses, suggesting that active learning strategies may help students overcome misconceptions better than didactic instruction.

The problem of misconceptions extends beyond content knowledge to media influences. Ferguson et al. (2022) showed that popular media often inaccurately portrays evolution, reinforcing misconceptions such as linear progression and the belief that individual organisms evolve, which can influence students' preconceptions before formal school instruction begins.

Research also shows that addressing students' personal concerns and contexts can improve evolution instruction. Bertka et al. (2019) developed a proactive teaching strategy that explicitly acknowledged students' religious and cultural concerns, finding that this approach reduced tension around evolution instruction and facilitated engagement with the evidence while respecting students' backgrounds.

The literature further indicates that persistent cognitive challenges are intertwined with acceptance. Studies such as those by Aini et al. (2024) found that students' religious beliefs and levels of understanding strongly influenced their acceptance of evolution — with highly religious students showing lower acceptance even when they understood evolution content.

Recent studies also document that evolution acceptance is often correlated with conceptual understanding. For instance, a 2023 Mexican study reported that while high school students' acceptance of evolution varied, comprehension scores tended to be low, and understanding was positively correlated with acceptance — but religion remained a key factor negatively affecting both understanding and acceptance. Other research highlights evolution education concerns from the perspective of teacher preparation and professional development. Newall and Reiss (2023) argue that teacher educators should treat evolution both as conceptually demanding and sensitive due to cultural or religious concerns, recommending pedagogies that help future teachers navigate these tensions in the classroom. In addition, a 2025 Philippine study on pre-service science teachers found that despite moderate acceptance of evolution, these teachers retained high levels of misconceptions and very low understanding of evolution concepts — underscoring the continued need for instructional interventions that link both understanding and acceptance in teacher education programs.

Finally, science education researchers have emphasized interdisciplinary and holistic approaches for evolution instruction. Hanisch (2020) advocated for more general, interdisciplinary treatments of evolutionary theory in education, suggesting that broader frameworks could help students integrate evolutionary ideas across biological subtopics and reduce fragmented or isolated knowledge that contributes to misconceptions.

Together, these studies highlight that misconceptions and acceptance of evolution are persistent, influenced by both cognitive and cultural factors, and that targeted pedagogical strategies (including inquiry-based learning, explicit acknowledgment of student beliefs, and interdisciplinary frameworks) show promise for fostering conceptual change and increasing acceptance.

2.2. Evolution Education Challenges

Evolution is widely recognized as the foundational theory of biology, yet students at all levels—from high schools to universities—often struggle to understand and accept it. Research reveals that students hold persistent misconceptions about natural selection, adaptation, and common ancestry, which are resistant to traditional instruction. Many students anthropomorphize evolutionary change or incorrectly believe evolution occurs within an individual's lifetime, rather than over generations through population changes. These misconceptions are deeply rooted in intuitive reasoning and prior beliefs, which makes conceptual change difficult without effective instructional interventions.

Systematic reviews of evolution education indicate that misconceptions commonly include teleological thinking (e.g., "evolution has a purpose"), Lamarckian ideas (e.g., "acquired traits are inherited"), and attributing conscious intention to natural selection. These beliefs, often developed early in life, continue into adulthood and hamper students' ability to grasp scientific explanations.

2.3. Evolution Acceptance and Educational Contexts

Research also emphasizes that acceptance of evolution is not synonymous with understanding it. Many learners who score moderately well on scientific knowledge tests still reject evolution as a valid scientific explanation, often due to cultural, religious, or worldview conflicts. Acceptance is influenced by personal beliefs about science and religion, understanding of the nature of science, and educational experiences. Instruction that fosters respect for students' worldviews and separates scientific explanation from personal belief has been shown to reduce resistance and enhance acceptance.

In European education settings, literature highlights variation in evolution instruction across countries. Misconceptions and low acceptance have often been linked to insufficient curriculum emphasis on evolution and inappropriate presentation of evolutionary concepts in syllabi.

2.4. The Role of Teachers and Instruction

Studies on teachers reveal that educators themselves may lack adequate training in evolution or harbor misconceptions, limiting their ability to challenge student misconceptions effectively. Teachers' personal beliefs, understanding of the nature of science, and comfort with the subject are critical factors influencing how evolution is taught and how effectively students learn it. Interventions that explicitly acknowledge concerns about belief conflicts, emphasize scientific evidence, and employ reflective teaching practices can improve both teacher and student acceptance.

Research on instructional strategies also underscores the importance of active learning, critical reasoning, and engaging students in confronting misconceptions. Pedagogical approaches such as inquiry-based learning, constructivist strategies, and conceptual change frameworks help students transition from naive understandings toward scientifically accurate conceptions. Effective teaching involves not only delivering content but also addressing underlying beliefs that shape how students interpret scientific explanations.

2.5. Related Studies

Empirical Evidence on Evolution Acceptance and Misconceptions

2.5.1. Understanding and Acceptance in High School Students (Mexico, 2023).

In a study of 370 Mexican high school students, researchers measured evolution acceptance using validated tools and found moderate to high acceptance levels but low comprehension of evolutionary concepts. The study showed a positive correlation between understanding and acceptance, indicating that understanding ecological and evolutionary mechanisms reinforces acceptance. Religion was identified as a strong factor negatively influencing both acceptance and understanding.

2.5.2. Filipino High School Students' Knowledge and Acceptance (Philippines, 2024).

Research evaluating Filipino senior high school students found that knowledge about evolution significantly predicts acceptance levels. Students with a stronger grasp of evolutionary concepts tended to show higher acceptance, while misconceptions were prevalent. The authors recommended enhancing evolution content emphasis and instructional quality to dispel misconceptions and build acceptance progressively.

2.5.3. Misconceptions Among Secondary Students (Nigeria, 2024).

A mixed-methods study of senior secondary students in Nigeria revealed widespread misconceptions particularly related to natural selection, genetic variation, and common ancestry. Religious beliefs and cultural narratives were cited as major influences on students' misconceptions, suggesting that instructional strategies must be culturally sensitive and scientifically grounded to effectively address these learning barriers.

2.5.4. Filipino Pre-Service Science Teachers' Evolution Constructs (2025).

Emerging research in the Philippines on pre-service science teachers highlighted that understanding, acceptance, and misconceptions about evolution are strongly correlated. The study found that limited empirical research exists locally on how these factors relate, pointing to a need for targeted research in teacher education to improve evolution instruction in schools.

2.5.5. Undergraduate Acceptance of Evolution (Philippines, 2021).

A study of university students in Mindanao showed that acceptance of evolution was moderate to high across science and non-science majors. However, the research recommended developing STEM-based instructional designs tailored to address misconceptions and enhance conceptual understanding of evolutionary theory among learners.

2.6. Instructional Interventions and Conceptual Change

While modern studies vary in context, several investigations underscore the importance of instructional interventions designed to address misconceptions directly and facilitate conceptual change:

- **Inquiry and Laboratory-Centered Approaches** have been shown to improve understanding and reduce misconceptions compared to traditional lecture-based teaching. These studies indicate that engaging students in hands-on exploration and reflection on evidence can strengthen acceptance and conceptual clarity. (e.g., Johnston et al., 2022)
- **Philosophical and Socio-Cultural Dialogues** regarding perceived conflict between evolution and belief systems have been found to improve acceptance when integrated into instruction. (Bernhard, 2024)

Although some studies focus on university contexts, their findings are relevant because high school learners often enter post-secondary education with persistent misconceptions carried forward from earlier schooling, reinforcing the need for effective strategies at the senior high level.

2.7. Synthesis of Literature and Studies

The reviewed literature and studies affirm that **misconceptions about evolution are persistent**, **acceptance of evolution varies**, and **instructional approaches significantly influence both**. Students often bring intuitive, culturally shaped ideas into the classroom that conflict with scientific explanations. Traditional instruction frequently fails to confront these ideas directly, which perpetuates resistance and misunderstanding.

Understanding and acceptance are correlated; students who comprehend evolution's mechanisms tend to accept it more readily, but understanding alone does not guarantee acceptance due to emotional, cultural, and belief-based barriers. This underscores the need for instructional strategies that combine accurate scientific content with pedagogical frameworks sensitive to learners' beliefs.

The concept of Evolution Acceptance Framing aligns with these findings because it acknowledges students' pre-existing beliefs and uses evidence-based instruction to reduce resistance and encourage conceptual change. This approach diverges from traditional teaching by emphasizing respect, relevance, and dialogue, aligning with recommendations from recent research that instructional strategies should address both cognitive and affective domains of learning.

3. Research methodology

This chapter presents the detailed methodology employed to investigate the effect of Evolution Acceptance Framing on misconception resistance among Grade 12 students. The methodology is designed to ensure that the study is conducted in a systematic, reliable, and valid manner, allowing meaningful conclusions to be drawn from the findings.

The study specifically aims to measure how instructional strategies that frame evolution in a supportive and non-confrontational manner can influence students' acceptance of evolution and reduce persistent misconceptions. This chapter includes a comprehensive discussion of the research design, participants, research instruments, data-gathering procedures, statistical treatment of data, and ethical considerations. By following these methods, the study seeks to ensure transparency and reproducibility while maintaining the integrity of the research process.

3.1. Research Design

This study utilized a **Descriptive Quantitative**. This design was chosen because it allows the researcher to examine the effect of an instructional intervention while accounting for existing differences between groups that cannot be fully randomized in a classroom setting.

According to Josephine Oranga and Audrey Matere (2025) describes characteristics of a population or phenomenon without establishing cause-effect relationships and answers questions like "what are the characteristics?", "What are the trends?", or "What is the current situation?" rather than "why" questions, by observing and recording data without manipulating variables. Accordingly, this approach is often used to establish baselines, identify trends, and provide detailed accounts of a subject (Babbie, 2020; Creswell & Creswell, 2018. Oranga, Njurai and Matere (2025) also emphasize that in descriptive studies, researchers observe and record data without attempting to control or manipulate the variables being studied. Noteworthily, descriptive research can utilize both numerical data (quantitative) and descriptive narratives (qualitative).

The study follows the **Input–Process–Output (IPO) model**, which provides a structured framework for examining how instructional interventions influence student outcomes. The **input** consists of students' prior knowledge, misconceptions, and learning competencies. The **process** involves the delivery of instruction and interactive activities. The **output** includes post-intervention levels of evolution acceptance and misconception resistance.

By comparing pretest and posttest results between the experimental and control groups, the study can determine whether Evolution Acceptance Framing is more effective than traditional instruction in promoting conceptual understanding and acceptance of evolution.

3.2. Participants of the Study

The participants of this study were **Grade 12 students** enrolled in the biology subject during the **academic year 2025–2026** at a selected senior high school.

- **Sampling Technique:** Purposive sampling was used to select participants who were currently taking the evolution unit in biology. This ensured that all students had similar exposure to the curriculum and were appropriate candidates for the intervention.
- **Number of Participants:** Two intact sections were selected, each consisting of approximately 30–35 students. One section was randomly assigned as the experimental group, and the other served as the control group.

3.2.1. Inclusion Criteria:

- Currently enrolled in Grade 12 biology.
- Present during all phases of the pretest, intervention, and posttest.
- Provided informed consent to participate in the study.

3.2.2. Exclusion Criteria:

- Students absent for more than two sessions during the intervention.
- Students who did not submit signed consent forms.

This participant selection ensures that the sample represents the target population of Grade 12 students while maintaining ethical standards and minimizing potential confounding variables.

3.3. Research Instruments

Two research instruments were used to measure the study variables:

3.3.1. Evolution Acceptance Questionnaire (EAQ)

- Measures the degree to which students accept evolution as a scientific explanation.
- Includes a **Likert-scale** format (1 = strongly disagree to 4 = strongly agree).

Mean Score	Interpretation
1.00-1.75	Very Low Misconception
1.76-2.50	Low Misconception
2.51-3.25	High Misconception
3.26-4.00	Very High Misconception

- Covers multiple dimensions such as understanding of evolutionary mechanisms, compatibility of evolution with worldviews, and confidence in scientific reasoning.

3.3.2. Misconception Test on Evolution (MTE)

- Measures the prevalence of misconceptions about evolution.
- Includes **multiple-choice**, **true/false**, and **scenario-based questions**.
- Assesses common misconceptions, including teleological thinking, Lamarckian inheritance, and misunderstanding of natural selection.

3.4. Validity and Reliability:

- Both instruments were validated by **biology education experts** to ensure content accuracy and relevance.
- A pilot test was conducted with a small group of students not participating in the main study.
- Cronbach's alpha values for both instruments exceeded **0.80**, indicating high internal consistency and reliability.

The combination of these instruments ensures that both the cognitive and affective dimensions of evolution learning are measured comprehensively.

3.5. Data Gathering Procedure

The study followed a systematic procedure to ensure consistency and reliability:

- **Permission and Consent:** Approval was obtained from school authorities, and informed consent was secured from students and their parents. Students were briefed on the purpose of the study, confidentiality measures, and voluntary nature of participation.
- **Pretest Administration:** Both the experimental and control groups completed the EAQ and MTE before any instructional intervention. This established baseline data on evolution acceptance and misconceptions.
- **Intervention Implementation:**
  - **Experimental Group:** Received the Evolution Acceptance Framing strategy through interactive lessons, discussions, and examples highlighting the compatibility of evolution with different worldviews.
  - **Control Group:** Received traditional lecture-based instruction, focusing on factual knowledge without addressing misconceptions or belief conflicts.
- **Posttest Administration:** After the intervention, both groups completed the EAQ and MTE to measure changes in evolution acceptance and misconception resistance.
- **Data Analysis:** The pretest and posttest results were analyzed to determine whether the experimental group showed significant improvement compared to the control group.

This procedure ensures that the intervention is delivered consistently and that data collected accurately reflects the effect of the Evolution Acceptance Framing strategy.

3.6. Statistical Treatment of Data

The data collected were analyzed using **quantitative statistical methods**:

- **Descriptive Statistics:**
  - Mean and standard deviation were used to summarize pretest and posttest scores for evolution acceptance and misconception resistance.
- **Inferential Statistics:**
  - **Paired t-test:** Determined significant differences within each group between pretest and posttest scores.
  - **Independent t-test:** Determined significant differences between the experimental and control groups after the intervention.

The level of significance was set at **0.05** for all tests. Statistical analyses were performed using **SPSS version 25**, which ensured accurate and reliable results.

3.7. Ethical Considerations

Ethical standards were strictly observed throughout the study. Participation was voluntary, and informed consent was obtained from all participants prior to data collection. The study adhered to established ethical guidelines in educational research

Ethical principles were strictly observed throughout the study:

- **Voluntary Participation:** Students were informed that participation was voluntary and that they could withdraw at any time without any penalty.
- **Confidentiality:** Students' identities were protected using coded responses, ensuring anonymity in data analysis and reporting.
- **Minimal Risk:** The study involved classroom activities and questionnaires only, which posed no physical or psychological harm to participants.
- **Transparency:** The purpose, procedures, and expected outcomes of the study were explained to both students and parents.

These measures ensured that the study was conducted in accordance with standard ethical guidelines for research involving human participants.

4. Result and Discussion

This section presents the analysis and interpretation of data on the misconception level of respondents in relation to sex, academic strand, and age. Difference in Misconception Level in Terms of Sex, Difference in Misconception Level in Terms of Academic Strand and the Relationship between Age and Misconception Level

4.1. Respondent's Profile

Table 1 Frequency and Percentage Distribution of Respondents in terms of Age

Age	Frequency	Percent
16	5	14.30
17	15	42.90
18	12	34.30
19	3	8.60
Total	35	100.00

In terms of age distribution, the majority of respondents are 17 years old (42.9%), followed by 18 years old (34.3%), 16 years old (14.3%), and 19 years old (8.6%). This indicates that most participants are in the middle years of senior high school, which is appropriate for studies involving SHS learners.

Table 2 Frequency and Percentage Distribution of Respondents in terms of Sex

Sex	Frequency	Percent
Male	11	31.40
Female	24	68.60
Total	35	100.00

On the other hand, sex the sample is female-dominated (68.6%), while males comprise 31.4%. This imbalance suggests that findings may be more reflective of female perspectives, which should be considered when generalizing results.

Table 3 Frequency and Percentage Distribution of Respondents in terms of Academic Strand

Academic trand	Frequency	Percent
ABM	7	20.0
GAS	8	22.9
HUMSS	8	22.9
STEM	12	34.3
Total	35	100.0

In terms of academic strand, the largest group comes from STEM (34.3%), followed by GAS (22.9%), HUMSS (22.9%), and ABM (20.0%). This shows a fairly balanced representation across strands, although STEM students form the largest proportion. This distribution allows for diverse academic perspectives, but with slight emphasis on science-oriented learners.

The respondents are mostly 17-year-old female students, with a moderately balanced representation across academic strands, though slightly dominated by STEM. The relatively uniform age and diverse academic backgrounds provide a good basis for analyzing trends, but the gender imbalance should be acknowledged as a potential limitation.

Table 4 Level of Students' Misconception on Evolution Before Intervention

Indicator	Mean	Verbal Interpretation
1. Humans and modern apes share a common ancestor.	2.60	High Misconception
2. Evolution explains the diversity of life on Earth through natural selection.	2.60	High Misconception
3. I accept the scientific evidence for evolution by natural selection.	2.91	High Misconception
4. The fossil record provides strong evidence that species change over time.	2.63	High Misconception
5. Similarities in DNA between species support the idea of common descent.	2.63	High Misconception
6. Antibiotic resistance in bacteria is an example of evolution happening today.	2.54	High Misconception
7. My religious beliefs conflict with the theory of evolution.	2.63	High Misconception
8. Evolution is "just a theory" and not a proven fact.	2.69	High Misconception
9. Intelligent design better explains life's complexity than evolution.	2.31	Low Misconception
10. Humans were specially created and did not evolve from earlier species.	2.31	Low Misconception
Overall Mean	2.59	High Misconception

The data indicate that students generally exhibited a high level of misconception about evolution prior to the intervention, as reflected by the overall mean of 2.59, which falls under the High Misconception category.

Individual indicators, eight out of ten items (Q1–Q8) were interpreted as High Misconception, with mean scores ranging from 2.54 to 2.91. Among these, Q3 recorded the highest mean (2.91), suggesting that this particular concept is the most misunderstood by students. This implies that certain evolutionary concepts may be especially difficult for learners to grasp, possibly due to abstract ideas, prior beliefs, or insufficient instructional emphasis. On the other hand, Q9 and Q10 both obtained a mean of 2.31, interpreted as Low Misconception. This suggests that students have relatively better understanding of the concepts measured in these items compared to the others.

Overall, the findings reveal that students possess a high level of misconceptions about evolution prior to the intervention, as most indicators fall under the High Misconception category. Only a few areas show lower misconception levels, indicating that while some concepts are better understood, the majority still require instructional reinforcement

4.2. Significant difference between the respondent profile and misconception in evolution before the intervention?

Table 5 Significant Difference on Misconception Level of Respondents in terms of Sex

	t	df	p
Sex - Misconception Level	-0.156	32.31	0.877
p-value > 0.05, no significant difference			

There is no significant difference in the misconception level of respondents in terms of sex ($t = -0.156$, $p = 0.877 > 0.05$).; The analysis revealed a computed t-value of **-0.156** with **32.31 degrees of freedom** and a corresponding p-value of **0.877**. Since the p-value is greater than the 0.05 level of significance (**p > 0.05**), the result is **not statistically significant**.

Therefore, the null hypothesis is **not rejected**, indicating that there is **no significant difference** in the misconception level of respondents when grouped according to sex. This means that both male and female respondents exhibit **similar levels of misconceptions**.

4.3. Significant Difference on Misconception Level of Respondents in terms of Academic Strand

Table 6 Significant Difference on Misconception Level of Respondents in terms of Academic Strand

	Sum of Squares	df	Mean Square	F	p
Academic Strand	0.508	3	0.169	1.003	0.405
Misconception Level	5.235	31	0.169		
p-value > 0.05, no significant difference					

There is no significant difference in misconception level across academic strands (F = 1.003, p = 0.405 > 0.05).; **Academic Strand** has a sum of squares of **0.508** with **3 degrees of freedom**, and a mean square of **0.169**. The computed **F-value is 1.003** with a corresponding **p-value of 0.405**.; Since the p-value is greater than the 0.05 level of significance (**p = 0.405 > 0.05**), the result is **not statistically significant**. Therefore, the null hypothesis is **not rejected**.

This indicates that there is **no significant difference** in the misconception level of respondents when grouped according to academic strand. In other words, students from different academic strands exhibit **similar levels of misconceptions**.

Table 7 Significant Correlation on Age and Misconception Level

Variable		**Age**	**Misconception Level**
Age	Pearson's r	—	
Misconception Level	Pearson's r	-0.120	—
very weak negative correlation			

There is a very weak negative correlation between age and misconception level (r = -0.120), indicating a negligible relationship.; The analysis shows a **Pearson's r value of -0.120** between age and misconception level. This indicates a **very weak negative correlation**.

This means that as age increases, the level of misconceptions tends to slightly decrease, but the relationship is minimal and negligible.

Since the correlation coefficient is very close to zero, the relationship between age and misconception level is not strong enough to be considered meaningful. If the p-value is greater than 0.05 (not shown in the table), this would further indicate that the correlation is not statistically significant.

4.4. Summary of Findings

This study examined the misconception level of respondents in relation to sex, academic strand, and age.

- Difference in Misconception Level in Terms of Sex: The analysis revealed that there is no significant difference in the misconception level of respondents when grouped according to sex (t = -0.156, p = 0.877 > 0.05). This indicates that both male and female respondents have comparable levels of misconceptions.
- Difference in Misconception Level in Terms of Academic Strand: The findings showed that there is no significant difference in the misconception level across different academic strands (F = 1.003, p = 0.405 > 0.05). This suggests that students from various academic strands exhibit similar levels of misconceptions.
- Correlation between Age and Misconception Level: The results indicated a very weak negative correlation between age and misconception level (r = -0.120). This implies that as age increases, misconception levels tend to slightly decrease, but the relationship is negligible and not meaningful.

The misconception level of respondents is not significantly influenced by sex, academic strand, or age, indicating that misconceptions are consistently present across different groups.

5. Conclusion

Based on the results of the study, it can be concluded that the misconception level of respondents is not significantly influenced by sex, academic strand, or age. The findings revealed no significant differences in misconception levels when respondents were grouped according to sex and academic strand, indicating that these variables do not contribute to variations in students' understanding.

Furthermore, the relationship between age and misconception level was found to be very weak and negligible, suggesting that age does not play a meaningful role in reducing or increasing misconceptions.

Misconceptions appear to be consistently present across different groups of respondents, regardless of their demographic profile. This implies that misconceptions may stem from common learning experiences, instructional methods, or gaps in conceptual understanding rather than individual characteristics.

Recommendations

Based on the findings of the study, the following recommendations are proposed:

- **Enhance Instructional Strategies** Teachers should use **varied and interactive teaching methods** (e.g., concept mapping, simulations, inquiry-based learning) to address and correct students' misconceptions, since these are present across all groups regardless of sex, age, or academic strand.
- **Conduct Diagnostic Assessments** Educators are encouraged to administer **pre-assessments or diagnostic tests** to identify existing misconceptions before introducing new lessons. This allows for targeted and effective instruction.
- **Strengthen Conceptual Understanding** Instruction should focus more on **deep understanding of concepts** rather than memorization. Teachers may use real-life applications and examples to make learning more meaningful.
- **Provide Remediation Programs** Schools may implement **remedial classes, tutorials, or intervention programs** aimed at addressing common misconceptions shared by students.
- **Professional Development for Teachers** Teachers should be given opportunities for **training and workshops** on identifying and correcting misconceptions using evidence-based teaching strategies.
- **Utilize Learning Resources and Technology** The use of **multimedia tools, virtual labs, and educational platforms** is recommended to help clarify difficult concepts and engage students more effectively.
- **Future Research** Future researchers may explore other variables (e.g., teaching methods, learning styles, prior knowledge, or exposure to instruction) that may influence misconception levels, since demographic factors were found to have no significant effect.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] Anderson, D. L., Fisher, K. M., & Norman, G. J. (2002). Development and evaluation of the conceptual inventory of natural selection. Journal of Research in Science Teaching, 39(10), 952–978.

[2] Barnes, M. E., Dunlop, H. M., Holt, E. A., Zheng, Y., Brownell, S. E. (2017). Different evolution acceptance instruments lead to different research findings. Evolution: Education and Outreach, 10(1), 1–15.

[3] Cobern, W. W. (1994). Worldview theory and conceptual change in science education. Science Education, 78(6), 583–610.

[4] Ainsworth, S., Prain, V., & Tytler, R. (2011). Drawing to learn in science. Science, 333(6046), 1096–1097. https://doi.org/10.1126/science.1204153

[5] Aini, R. N., Shahrill, M., & Ling, L. C. (2024). Examining university students' misconceptions of evolution: Implications for biology teaching. Journal of Biological Education. https://doi.org/10.1007/s11191-023-00428-5

[6] Alters, B. J., & Nelson, C. E. (2002). Teaching evolution in higher education: Philosophy, acceptance, and science. Evolution: Education and Outreach, 1(2), 66–75. https://doi.org/10.1007/s12052-008-0009-6

[7] Bertka, C. M., Rissler, L. J., & Currano, E. D. (2019). Reconciling evolution instruction with students' personal worldviews: An exploratory strategy. Evolution: Education and Outreach, 12(1), 1–13. https://doi.org/10.1186/s12052-019-0095-0

[8] Bernhard, J. M. (2024). Philosophical dialogue and evolution acceptance in biology classrooms. International Journal of Science Education, 46(5), 723–745. https://doi.org/10.1080/09500693.2023.2276685

[9] Clough, M. P. (2006). Understanding the nature of science: A historical perspective. Science & Education, 15(5), 493–508. https://doi.org/10.1007/s11191-004-5154-3

[10] Dagher, Z. R., & BouJaoude, S. (1997). Students' perceptions of science: A cross-cultural study. Journal of Research in Science Teaching, 34(6), 553–565. https://doi.org/10.1002/(SICI)1098-2736(199708)34:6<553::AID-TEA3>3.0.CO;2-B

[11] Donovan, S., & Bransford, J. D. (2005). How students learn: History, mathematics, and science in the classroom. National Academy Press.

[12] Evans, E. M. (2001). Cognitive and contextual factors in the emergence of diverse belief systems about evolution. Educational Psychologist, 36(1), 53–68. https://doi.org/10.1207/S15326985EP3601_6

[13] Ferguson, J., Taylor, J., & Clough, M. (2022). Misleading media representations and students' evolution misconceptions. Evolution: Education and Outreach, 15(1), 1–15. https://doi.org/10.1186/s12052-022-00179-x

[14] Gallagher, J. J., & Parker, J. (1994). Learning from instruction about natural selection. Review of Educational Research, 64(1), 1–35. https://doi.org/10.3102/00346543064001001

[15] Hanisch, J. (2020). Interdisciplinary approaches to teaching evolution: Research and practice. Evolution: Education and Outreach, 13(1), 1–12. https://doi.org/10.1186/s12052-020-00138-4

[16] Johnson, D. W., Johnson, R. T., & Smith, K. A. (2014). Cooperative learning: Improving university instruction by basing practice on validated theory. Journal on Excellence in College Teaching.

[17] Johnston, W., Thompson, T., & Nehm, R. (2022). Inquiry-based evolution instruction: Effects on conceptual understanding and misconception resistance. Evolution Education and Outreach, 15(1), 1–13. https://doi.org/10.1186/s12052-022-00164-4

[18] Kampourakis, K. (2014). Understanding Evolution: An Introduction. Cambridge University Press.

[19] Lombrozo, T. (2010). The role of explanation in learning and reasoning. Trends in Cognitive Sciences, 14(10), 429–436. https://doi.org/10.1016/j.tics.2010.07.005

[20] Mayer, R. E. (2009). Multimedia Learning (2nd ed.). Cambridge University Press.

[21] National Research Council. (1996). National Science Education Standards. National Academies Press.

[22] National Research Council. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. The National Academies Press.

[23] Newall, M., & Reiss, M. (2023). Evolution hesitancy: Challenges for teachers and educators. Journal of Biological Education, 57(3), 245–260.