

Design and Evaluation of Activity-Based Instructional Materials for Teaching Evolution and Enhancing Science Process Skills

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ABSTRACT

This study aimed to develop and evaluate an inquiry-based activity sheet on the topic of evolution for Grade 11 learners. A developmental research design was employed, involving curriculum mapping, drafting of instructional content, expert validation, revision, and evaluation by science teachers and school administrators. The activity sheet was designed to align with curriculum standards while promoting inquiry-based learning and the development of science process skills. The developed instructional material underwent face and content validation by a panel of experts to ensure accuracy, clarity, alignment, and instructional quality. Feedback from the validators guided the revision and improvement of the material. Subsequently, the revised activity sheet was evaluated using a standardized instrument adapted from the Department of Education Evaluation Rating Sheet for Print Resources. The evaluation covered four components: content, format, presentation and organization, and accuracy and up-to-datedness of information. Results showed that the activity sheet obtained a very satisfactory rating in content ($M = 3.86$), format ($M = 3.83$), and presentation and organization ($M = 3.83$), indicating that the material is appropriate, well-structured, and supports higher-order thinking skills. It also achieved a perfect rating in accuracy ($M = 4.00$), suggesting that conceptual, factual, and grammatical errors were not present. The findings indicate that the developed activity sheet is a valid and high-quality instructional material suitable for teaching evolutionary biology. Although not implemented in a classroom setting, the material demonstrates strong potential to support effective science instruction.

Keywords: evolutionary biology, instructional materials, activity sheet, science process skills, inquiry-based learning, validation

INTRODUCTION

Evolution is a foundational concept in biology because it explains the diversity of life, the relationships among organisms, and the processes that shape biological change over time. Despite its central role in science, evolution remains one of the most challenging topics for students to understand due to its abstract nature, the complexity of its mechanisms, and the persistence of misconceptions. Recent work continues to show that students' conceptual understanding of evolution is influenced not only by content exposure but also by how learning experiences are designed to promote deeper reasoning, evidence-based thinking, and engagement with authentic biological data. For example, Baytelman, Loizou, and Hadjiconstantinou (2023) reported that conceptual understanding of evolution is closely linked to learners' ways of thinking about scientific knowledge, highlighting the need for instructional approaches that go beyond rote memorization and support meaningful conceptual development.

In biology education, there is growing recognition that effective instruction should not only develop content knowledge but also strengthen students' science process skills. These skills include observing, classifying, predicting, inferring, organizing data, analyzing results, and communicating scientific explanations. Recent research emphasizes that science process skills are fundamental to scientific learning because they allow students to actively construct knowledge through inquiry and investigation. Mursali, Hastuti, and Zubaidah (2024) found that guided inquiry learning significantly improved both students' science process skills and conceptual understanding, suggesting that instructional materials that embed inquiry processes can support deeper learning outcomes. Similarly, recent work on practical biology learning has shown that active engagement in practical or inquiry-based tasks can enhance science process skills and academic performance in biology (Apeadido et al., 2024).

The development of instructional materials that explicitly integrate science process skills has also received strong attention in recent literature. Studies on biology worksheets, practicum guides, and project-based learning resources indicate that well-designed learning materials can improve students' independence, engagement, and scientific reasoning. For instance, Pandia, Wahyuni, and Nursamsu (2023) reported that project-based practicum worksheets were valid and practical for improving science process skills, while Chaniago, Kartika, and Siburian (2023) showed that science-process-skill-based practicum guides can support concept building through direct empirical experience. These findings suggest that instructional materials become more effective when they are carefully aligned with curriculum competencies, incorporate guided inquiry tasks, and provide structured opportunities for learners to observe, interpret, and communicate scientific evidence.

In the context of evolution education, this need is even more important. Recent reviews indicate that some areas of evolution, particularly molecular evolution, remain underrepresented in teaching resources and education research, even though they are essential for helping students understand evolutionary relationships using modern biological evidence. Forsythe and Hsu (2023) noted that molecular evolution education remains a relatively small area within the broader evolution education literature, pointing to the need for more instructional resources that connect evolutionary concepts with authentic scientific tools and data analysis. This gap suggests that students may benefit from learning materials that integrate both traditional evidence of evolution and contemporary molecular approaches, allowing them to better understand how evolutionary relationships are established in modern biology.

Moreover, instructional quality depends not only on content accuracy but also on the validity, clarity, structure, and usability of the materials used in the classroom. Recent research underscores the importance of validating science-learning instruments and materials to ensure that they accurately measure or support targeted learning outcomes. Tauhidah and Rofi'ah (2023) emphasized that science process skills are essential in biology learning and that educational tools intended to assess or support such skills require careful validation before classroom use. This supports the need to develop instructional materials that are systematically designed, reviewed by experts, and evaluated by practitioners before implementation.

Given these concerns, there is a strong need to develop curriculum-aligned, inquiry-based instructional materials for teaching evolution that are capable of enhancing both conceptual understanding and science process skills. Activity sheets are particularly promising because they can organize learning into manageable tasks, guide students through inquiry processes, and provide opportunities for reflection, analysis, and application. When carefully designed, such materials can help students engage more actively with scientific ideas and reduce difficulties associated with abstract biological concepts.

Thus, this study focuses on the development and evaluation of an inquiry-based activity sheet on the topic of evolution for Grade 11 learners. Specifically, it aims to determine the validity, quality, and suitability of the developed instructional material as assessed by experts, science teachers, and school administrators. By integrating curriculum competencies, inquiry-based activities, contextualized examples, and scientific tools, the study seeks to contribute to the improvement of instructional materials in biology education and provide a validated resource that can support effective teaching of evolutionary concepts.

METHODOLOGY

Research Design

This study employed a developmental research design aimed at designing, validating, and evaluating an inquiry-based instructional material on the topic of evolution for Grade 11 learners. The study focused on the systematic development of activity sheets aligned with curriculum standards and the assessment of their quality and suitability for classroom use. The development process followed a structured sequence consisting of curriculum mapping, drafting of instructional content, expert validation, revision, and evaluation by teachers and school administrators. The study did not involve classroom implementation or experimental testing; rather, it emphasized the validation and evaluation of the instructional material prior to its use in actual teaching.

Research Locale

The evaluation of the developed instructional material was conducted among selected science teachers and school administrators from a senior high school in the Philippines. The locale was chosen based on accessibility and relevance to the intended users of the instructional material, particularly those teaching Earth and Life Science in the senior high school level.

Participants of the Study

The participants of the study included a panel of experts, science teachers, and school administrators. The panel of experts, composed of the thesis adviser and subject specialists in science education, conducted the initial validation of the instructional material. Meanwhile, science teachers and school administrators served as evaluators who assessed the quality, usability, and instructional suitability of the developed activity sheet. Participants were selected through purposive sampling based on their expertise, teaching experience, and familiarity with curriculum standards and instructional material evaluation.

Research Instrument

The primary output of the study was an inquiry-based activity sheet designed to enhance learners' conceptual understanding of evolutionary biology and promote the development of science process skills. The material included essential instructional components such as an introduction, clearly defined learning objectives, content standards, performance standards, and learning competencies. It also incorporated structured learning activities organized into Engage, Explore, Explain, and Elaborate/Evaluate phases, along with guide questions, reflection tasks, performance-based activities, assessment rubrics, and a glossary of key scientific terms. To evaluate the instructional material, a standardized evaluation tool adapted from the Department of Education Evaluation Rating Sheet for Print Resources was used. The instrument assessed four major components: content, format, presentation and organization, and accuracy and up-to-datedness of information, using a four-point Likert scale ranging from 1 (Not Satisfactory) to 4 (Very Satisfactory).

Validation of the Instructional Material

The developed activity sheet underwent face and content validation by a panel of experts to ensure its quality and alignment with curriculum standards. The validation process focused on evaluating the accuracy of content, clarity of instructions, appropriateness of activities, integration of science process skills, and overall instructional design. The validators provided written comments and recommendations, which were carefully reviewed and incorporated into the revision of the instructional material. This process ensured that the final version of the activity sheet was systematically improved and met the standards of effective instructional materials.

Data Gathering Procedure

The data gathering procedure was conducted in three phases. In the first phase, the instructional material was developed through curriculum mapping, drafting, and preparation of the initial prototype. In the second phase, the material was subjected to expert validation, where feedback from the panel of experts was collected and used

to revise and refine the activity sheet. In the final phase, the revised instructional material was evaluated by science teachers and school administrators using the standardized evaluation rating sheet. The completed evaluation forms were collected and compiled for analysis.

Data Analysis

The data collected from the evaluation of the instructional material were analyzed using descriptive statistics, particularly the mean, to determine the overall quality and acceptability of the material. The mean scores for each component were interpreted using established descriptive equivalents to classify the level of quality (e.g., Very Satisfactory, Satisfactory). In addition, qualitative feedback from validators and evaluators was analyzed through content analysis to identify common themes related to strengths, areas for improvement, and suggested revisions.

Ethical Considerations

Ethical standards were observed throughout the study. Participation of the evaluators was voluntary, and their responses were treated with confidentiality. The data collected were used solely for research purposes, and proper acknowledgment of sources was ensured in the development of the instructional material. The study adhered to principles of academic integrity and ethical research practices.

RESULTS AND DISCUSSION

The development of the instructional material followed a systematic process consisting of curriculum mapping, drafting of the instructional content, expert validation, and evaluation by teachers and school administrators. Curriculum mapping was conducted to ensure that the learning objectives, learning activities, and assessment components of the instructional material were aligned with the prescribed curriculum competencies in science education. This step ensured that the material supports the intended learning outcomes and follows the standards set by the curriculum.

After the initial development, the instructional material underwent validation by a panel of experts who evaluated the content accuracy, instructional design, clarity of presentation, and overall relevance of the material. Their feedback was used to improve and refine the material before its classroom implementation. In addition, science teachers and school administrators evaluated the material using a standardized evaluation rating sheet to determine its suitability, usability, and instructional quality for classroom use.

Curriculum Mapping

Curriculum mapping was conducted to ensure that the developed instructional material was aligned with the prescribed learning competencies, content standards, and performance standards specified in the curriculum. This process is a critical step in instructional material development because it ensures that learning objectives, instructional activities, and assessment tasks are systematically aligned with the intended learning outcomes of the subject. Proper alignment between curriculum standards and instructional materials helps promote meaningful learning experiences and improves the effectiveness of science instruction (Richey & Klein, 2014). In addition, aligning instructional materials with curriculum goals supports coherent science learning and facilitates the development of students' conceptual understanding and scientific literacy (Faizin et al., 2024; Lestari et al., 2024).

In this study, curriculum mapping focused on the topic "The Process of Evolution." The mapping procedure involved identifying the relevant content standards, performance standards, and learning competencies outlined in the curriculum and aligning them with the instructional activities and assessment items included in the developed learning material. Such alignment is essential in evolution education because clear connections between learning objectives and instructional strategies help students understand complex biological concepts and reduce misconceptions about evolutionary processes (Ferguson et al., 2022; Pobiner, 2016). Through this alignment, the instructional material was designed to address the fundamental concepts and skills required for students to understand evolutionary mechanisms and relationships among organisms.

Table 1. Curriculum Mapping of the Activity Sheets on the Topic of Evolution

Content	Content Standard	Performance Standard	Learning Competencies	Code
The Process of Evolution	The learners demonstrate an understanding of the evidence for evolution and the origin and extinction of species.	The learners shall be able to design a poster tracing the evolutionary changes in a crop plant (e.g., rice or corn) that occurred through domestication.	<ol style="list-style-type: none"> 1. Describe evidence of evolution such as homology, DNA/protein sequences, plate tectonics, fossil record, embryology, and artificial selection/agriculture. 2. Explain how populations of organisms have changed and continue to change over time showing patterns of descent with modification from common ancestors to produce organismal diversity. 3. Describe how the present system of classification of organisms is based on evolutionary relationships. 	S11/12LT-IVfg-25 S11/12LT-IVfg-26 S11/12LT-IVfg-27

The content standard emphasizes that learners should understand the scientific evidence supporting evolution and the processes responsible for the origin and extinction of species. Evolutionary theory is considered a unifying framework in biology because it explains the diversity and relationships among organisms (Branch et al., 2023; McVaugh et al., 2010). Meanwhile, the performance standard requires learners to design a poster tracing the evolutionary changes in a crop plant, such as rice or corn, that occurred through domestication. This task encourages students to apply evolutionary concepts to real-world contexts and enhances their conceptual understanding and engagement in science learning (Ferguson et al., 2022; Pobiner et al., 2018).

The learning competencies focus on describing the evidence of evolution, explaining how populations change over time, and understanding how biological classification is based on evolutionary relationships. These competencies help develop students' conceptual understanding and ability to analyze biological evidence. Studies show that inquiry-based and evidence-based activities support students' understanding of evolutionary concepts and improve scientific reasoning skills (Faizin et al., 2024; Sulistyani et al., 2022).

To ensure alignment, the learning activities and assessment items were mapped according to the identified competencies. Activities included identifying evidence of evolution such as fossils, homology, DNA and protein sequences, embryology, and artificial selection, as well as explaining patterns of descent with modification and evolutionary relationships among organisms. Aligning instructional activities with competencies supports students in constructing scientific knowledge and applying evolutionary concepts effectively (Driver et al., 1994; Plummer et al., 2021).

Through this process, the instructional material ensured adequate coverage of the required competencies in the evolution unit. The alignment also confirmed that the activities and assessments were consistent with the curriculum standards and learning objectives.

Learning Competency Mapping of the Developed Activity Sheet

In relation to competency mapping, the targeted learning competencies were first identified based on the Grade 11 Earth and Life Science curriculum under the topic Process of Evolution. After identifying the competencies, the developed instructional material was organized into smaller and manageable subtasks to guide learners through a sequence of learning experiences.

The developed material was structured as activity-based activity sheets designed to promote inquiry-based learning and the development of science process skills. Each activity sheet contained a series of activities that encourage learners to observe, analyze, compare, interpret data, and communicate scientific explanations.

The instructional material was divided into three activity sheets, namely Activity sheet 1, Activity sheet 2, and Activity sheet 3, each focusing on a specific concept related to evolution. Each activity sheet contains four major learning segments (Engage, Explore, Explain, and Elaborate/Evaluate) that guide learners through progressive learning tasks within the allotted instructional time.

Table 2. Curriculum Mapping of the Developed Activity sheet on the Topic of Evolution

Learning Competencies	Topic	Subtasks	Activities and Label	Activity sheet
Describe evidence of evolution such as homology, DNA/protein sequences, plate tectonics, fossil record, embryology, and artificial selection.	Evidence of Evolution	Identify different types of evolutionary evidence. Analyze similarities and differences in anatomical structures. Relate evolutionary evidence to real-life examples.	Activity 1 – Tracing Evolution in the Philippine Context (Engage) Activity 2 – Station Adventure: Evidence of Evolution (Explore) Activity 3 – Evidence of Evolution Table Analysis (Explain) Activity 4 – Reflection on the Strongest Evidence of Evolution (Elaborate & Evaluate)	Activity sheet 1
Explain how populations of organisms have changed and continue to change over time showing patterns of descent with modification from common ancestors to produce organismal diversity.	Descent with Modification and Organismal Diversity	Describe population changes through time. Analyze real-life examples of evolutionary change. Explain how environmental and human factors influence evolution.	Activity 1 – Philippine Biodiversity Scenario (Engage) Activity 2 – Tracing Population Changes (Explore) Activity 3 – Population Change Analysis Table (Explain) Activity 4 – Descent with Modification Explanation (Elaborate)	Activity sheet 2
Describe how the present system of classification of organisms is based on evolutionary relationships.	Evolutionary Basis of Modern Classification	Compare gene sequences among organisms. Determine evolutionary relationships using molecular evidence. Interpret data to infer relatedness among species.	Activity 1 – Search and List Gene Sequences Using GenBank (Engage) Activity 2 – DNA Sequence Comparison Using MEGA Software (Investigate) Activity 3 – Relationship Analysis Table (Explain) Activity 4 – Reflection on Evolutionary Classification (Evaluate)	Activity sheet 3

Table 2 presents the curriculum mapping of the developed activity sheets on the topic of evolution. The table shows the alignment between the prescribed learning competencies in the Grade 11 Earth and Life Science curriculum, the specific topics covered in the instructional material, the subtasks designed to support learning, and the corresponding activities included in each activity sheet. This mapping ensured that the developed instructional material directly addressed the intended curriculum standards and competencies.

The first set of activities, presented in Activity sheet 1, focuses on the competency that requires learners to describe the different types of evidence supporting evolution, including homology, DNA or protein sequences, fossil records, embryology, plate tectonics, and artificial selection. The activities were designed to guide learners

in identifying, observing, and analyzing various forms of evolutionary evidence. Through tasks such as analyzing homologous structures and exploring different stations that present scientific evidence, learners were able to develop their understanding of how multiple lines of evidence support the theory of evolution.

The second set of activities, presented in Activity sheet 2, addresses the competency related to explaining how populations of organisms change over time through the process of descent with modification. The activities in this activity sheet emphasize real-life examples and contextualized scenarios, such as changes in Philippine biodiversity and the domestication of rice varieties. These activities allow learners to analyze factors that influence evolutionary change and understand how environmental conditions, isolation, and human selection contribute to population variation and organismal diversity.

Meanwhile, Activity sheet 3 focuses on the competency that requires learners to describe how modern biological classification is based on evolutionary relationships. In this activity sheet, learners perform tasks involving the comparison of DNA sequences using digital tools such as GenBank and MEGA software. These activities allow students to explore molecular evidence of evolution and understand how genetic similarities among organisms provide scientific basis for determining evolutionary relationships and classification.

Overall, the curriculum mapping presented in the table demonstrates that the developed activity sheets were systematically organized to address the required learning competencies while promoting meaningful and inquiry-based learning experiences. By breaking down each competency into specific subtasks and learning activities, the instructional material provides a structured approach that supports both conceptual understanding of evolution and the development of scientific thinking skills.

Alignment of Science Process Skills in the Developed Activity Sheets

The developed activity sheets were also designed to promote the development of Science Process Skills (SPS) among Grade 11 learners. Science process skills are essential abilities used by scientists and learners to investigate phenomena, analyze information, and communicate scientific explanations. These skills support inquiry-based learning and encourage students to actively participate in scientific investigation.

In the developed instructional material, science process skills were integrated throughout the learning activities to ensure that students not only acquire conceptual knowledge but also practice essential scientific skills. Each activity sheet activity required learners to observe scientific data, compare structures and information, analyze patterns, interpret results, and communicate conclusions based on evidence.

The integration of science process skills was evident in the different learning segments of the activity sheets, including Engage, Explore, Explain, and Elaborate/Evaluate activities. These tasks guided learners through a structured process of scientific inquiry where they actively constructed knowledge through observation, investigation, analysis, and reflection.

Table 3. Science Process Skills Integration in the Developed Activity Sheets

Activity sheet	Activity Title	Science Process Skills Developed	Description of Skill Application
Activity sheet 1	Tracing Evolution in the Philippine Context	Observing, Comparing, Classifying, Inferring, Communicating	Learners observe homologous structures in vertebrate forelimbs and compare similarities and differences to infer common ancestry and communicate their explanations.
	Station Adventure: Evidence of Evolution	Observing, Investigating, Analyzing Data, Communicating, Problem Solving	Students rotate through activity stations examining different types of evolutionary evidence such as fossils, DNA sequences, and embryology while recording and interpreting data.

	Evidence of Evolution Table Analysis	Analyzing Data, Classifying, Drawing Conclusions	Learners organize collected information in a table to identify patterns and relationships among different types of evolutionary evidence.
	Reflection on the Strongest Evidence of Evolution	Inferring, Communicating, Drawing Conclusions	Students explain which evidence best supports evolution and justify their reasoning using scientific arguments.
Activity sheet 2	Philippine Biodiversity Scenario	Observing, Inferring, Communicating	Learners analyze real-life scenarios involving Philippine biodiversity and identify factors that influence evolutionary change.
	Tracing Population Changes	Observing, Investigating, Problem Solving, Communicating	Students examine different scenarios such as island isolation and rice domestication to explain population changes over time.
	Population Change Analysis Table	Analyzing Data, Classifying, Drawing Conclusions	Learners organize observations and determine the causes of population changes and how these support descent with modification.
	Descent with Modification Explanation	Inferring, Communicating, Drawing Conclusions	Students write explanations on how evolutionary processes contribute to organismal diversity.
Activity sheet 3	Search and List Gene Sequences	Observing, Recording Data, Investigating	Learners use the GenBank database to locate and record gene sequences of selected organisms.
	DNA Sequence Comparison Using MEGA	Investigating, Analyzing Data, Comparing	Students use MEGA software to compare DNA sequences and determine evolutionary similarities and differences.
	Relationship Analysis Table	Analyzing Data, Comparing, Drawing Conclusions	Learners interpret sequence comparison results and determine evolutionary relationships among organisms.
	Reflection on Evolutionary Classification	Inferring, Communicating, Analyzing Data	Students explain how DNA evidence supports the modern classification of organisms based on evolutionary relationships.

Table 3 presents the integration of Science Process Skills (SPS) in the developed activity sheets on the topic of evolution. The table illustrates how specific activities in each activity sheet were intentionally designed to develop essential scientific skills among Grade 11 learners. Science process skills are fundamental competencies that enable students to investigate scientific phenomena, analyze information, and communicate explanations based on evidence. Integrating these skills into the instructional material ensures that learning goes beyond memorization of concepts and instead promotes active scientific inquiry.

In Activity sheet 1, learners were introduced to the different types of evolutionary evidence through activities that required observation, comparison, classification, and inference. For instance, learners analyzed homologous structures among vertebrate forelimbs, which encouraged them to observe similarities and differences and infer possible evolutionary relationships. The station-based activities further strengthened students' abilities to investigate scientific information, analyze patterns from various forms of evidence such as fossils and DNA, and communicate their findings through written responses and discussions.

Meanwhile, Activity sheet 2 focused on the application of science process skills in explaining evolutionary changes over time. Through contextualized scenarios involving Philippine biodiversity and rice domestication, students were guided to observe real-world examples, investigate the causes of population changes, and analyze how environmental and human factors influence evolution. These activities promoted problem-solving,

inference, and communication as learners interpreted scenarios and explained the concept of descent with modification.

In Activity sheet 3, higher-level science process skills such as investigating, analyzing data, and drawing conclusions were emphasized through technology-assisted activities. Learners used online scientific databases and software tools to compare DNA sequences and determine evolutionary relationships among organisms. These activities enabled students to apply scientific investigation skills similar to those used by researchers, thereby strengthening their understanding of how molecular evidence supports modern biological classification.

Overall, the integration of science process skills across the developed activity sheets demonstrates that the instructional material was designed to support both conceptual learning and the development of scientific thinking. By engaging learners in observation, investigation, analysis, and communication, the activities provide meaningful opportunities for students to practice essential skills used in scientific inquiry.

Development of the Activity sheet as an Instructional Material

The activity sheet was developed as an instructional material designed to support students' understanding of evolutionary biology while promoting the development of science process skills. The material was structured as an activity-based activity sheet that integrates conceptual explanations, inquiry-based tasks, and performance-based learning activities aligned with the prescribed curriculum competencies. Instructional material development requires systematic planning to ensure that learning activities, objectives, and assessments are aligned with curriculum standards and intended learning outcomes (Richey & Klein, 2014).

The development of the activity sheet was guided by principles of active and inquiry-based learning, where students engage directly in exploring scientific concepts through observation, analysis, and investigation. Inquiry-oriented learning materials have been shown to enhance students' scientific literacy and conceptual understanding by encouraging learners to participate actively in the learning process (Faizin et al., 2024). Thus, the activity sheet was designed to guide students through a sequence of activities that progressively build their understanding of evolutionary concepts while strengthening their science process skills.

The activity sheet includes several components that organize the learning process and provide clear guidance for both teachers and learners. These components consist of the introduction, learning standards, learning objectives, activity sections, performance tasks, and assessment tools. Presenting well-organized instructional components allows students to clearly understand lesson expectations and learning goals, which supports effective science learning (Lestari et al., 2024).

The first component of the activity sheet is the introduction, which provides a brief overview of the lesson and introduces the key concepts related to evolution. This section helps students recognize the relevance of the topic and prepares them for the learning activities that follow. Providing contextual explanations at the beginning of a lesson helps learners connect new knowledge with their existing understanding, which is an important principle of constructivist learning (Driver et al., 1994).

The activity sheet also presents the content standards, performance standards, and learning competencies derived from the curriculum. These standards serve as the foundation for the development of the learning activities and ensure that the instructional material is aligned with the expected learning outcomes. Clear alignment between curriculum competencies and learning activities helps students achieve deeper understanding and ensures that instructional materials effectively support curriculum implementation (Errabo et al., 2024).

Another component included in the activity sheet is the set of clearly defined learning objectives. These objectives describe what students are expected to learn after completing the activities and are written in measurable terms. Clearly articulated learning objectives help guide both instruction and assessment by specifying the knowledge and skills that learners are expected to develop (Schunk, 2012).

The core section of the activity sheet consists of activity-based learning tasks designed to promote inquiry and critical thinking. These activities allow students to explore evidence of evolution, examine evolutionary relationships among organisms, and interpret biological data. Inquiry-based activities are known to improve

students' understanding of scientific concepts and enhance their science process skills such as observation, classification, analysis, and interpretation (Sulistiyani et al., 2022).

The activity sheet also integrates technology-based learning activities that enable students to explore biological databases and scientific tools commonly used in biological research. Technology-supported learning experiences can help students visualize complex scientific relationships and improve engagement in science learning (Liu et al., 2020). Through these activities, students are given opportunities to analyze genetic information and investigate evolutionary relationships among organisms.

Guide questions and reflection questions are also included in the activity sheet to encourage critical thinking and deeper understanding of the concepts presented in the activities. These questions prompt students to analyze their observations, interpret scientific data, and connect evolutionary concepts to real-world biological phenomena. Reflective questioning is considered an effective strategy in science education because it helps students construct knowledge and develop scientific reasoning skills (Quirós et al., 2023).

Another major component of the activity sheet is the performance task, which requires students to apply their understanding of evolution by designing a poster that illustrates the evolutionary changes in a crop plant through domestication. Performance-based tasks allow students to demonstrate their conceptual understanding while applying scientific knowledge to authentic contexts, which enhances engagement and meaningful learning (Ferguson et al., 2022).

To evaluate students' outputs, the activity sheet includes assessment rubrics that provide clear criteria for evaluating performance tasks and learning outputs. Rubrics support fair and systematic assessment by clearly describing the expected level of student performance and learning outcomes (Burns, 2024).

Activity sheet includes learner support materials such as a glossary of key scientific terms related to evolution. Providing vocabulary support helps learners understand scientific terminology and improves their comprehension of complex biological concepts (Coyne et al., 2022). The developed activity sheet provides a structured and interactive learning material that integrates conceptual understanding, inquiry-based learning, and performance-based assessment. The organization of the instructional material ensures that students are guided through meaningful learning experiences that promote scientific inquiry, conceptual understanding, and the development of science process skills in studying evolutionary biology.

Earth and Life Science

Developed by: *Vanjo Madale*

Grade Level: 11

Time Allotment: 1 Hour

Topic 1
Evidence of Evolution
S11/12LT-IVfig-25

Topic 2
Descent with Modification and Organismal Diversity
S11/12LT-IVfig-26

Topic 3
Evolutionary Basis of Modern Classification
S11/12LT-IVfig-27

ACTIVITY SHEET 1

Tracing Evolution in the Philippine Context

Name: _____

Grade and Section: _____

Date: _____ Score: _____

Learning Targets
At the end of this activity, you should be able to:

1. Describe the different evidence that support the theory of evolution.
2. Analyze and interpret scientific data and visuals.
3. Relate evolutionary evidence to Philippine examples.
4. Communicate conclusions using scientific reasoning.

PART A. ENGAGE (10 minutes)
Direction: Carefully observe the illustration showing the forelimb structures of different vertebrates (turtle, dolphin, horse, human, bird, and bat). Focus on the shape, arrangement, and type of bones. Answer the questions briefly.

1. What similarities do you notice among the structures shown in figure 1?

2. What bones appear to be common in all the forelimbs shown, even if their shapes and sizes are different?

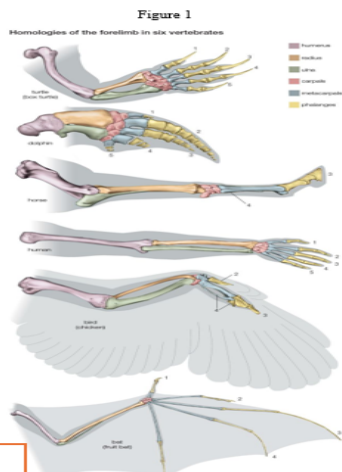
3. How are the forelimbs of the turtle, dolphin, horse, human, bird, and bat similar in structure but different in function?

4. What do you think is the reason why these animals have similarity in structure but different in uses?

5. Name a Philippine plant, animal, or landform that shows signs of change over time.

Figure 1

Homologies of the forelimb in six vertebrates



Science Process Skills
Observing, Comparing, Classifying, Inferring, Communicating

Score: /20

ACTIVITY SHEET 2

Patterns of Descent with Modification

Name:

Grade and Section:

Date: Score:

Learning Objectives

At the end of the activity, the students should be able to:

1. Explain how populations of organisms change over time.
2. Describe descent with modification from common ancestors.
3. Analyze examples of population change in Philippine contexts.
4. Communicate scientific explanations based on evidence.

PART A. ENGAGE (5 minutes)

Direction: Read the paragraph about Philippine organisms. Then answer the question in your own words.

The Philippines is known for its rich biodiversity, with many unique organisms such as the Philippine eagle, tarsier, and various rice varieties. Although these organisms share similarities with species in other parts of the world, they also show distinct traits found only in the Philippines.

1. Why do you think Philippine organisms are both like and different from organisms in other countries?

2. What factors might cause populations of organisms to change over long periods of time?

Score:
/10

PART B. EXPLORE (30 minutes)

Group Activity: Tracing Population Changes

Direction: In your group, read each scenario about population changes. Discuss with your group and write down your answers for each question.

Scenario 1: Island Populations

Millions of years ago, rising sea levels separated islands in the Philippines. A population of birds became isolated on different islands. Over time, these birds developed differences in beak size, feather color, and feeding behavior.

1. What caused the separation of the bird populations? (Example: a natural event that changed the land or sea).

2. What changes occurred in the populations over time? (Example: changes in body parts or behavior)

3. How do these changes show descent with modification? (Ex: birds came from the same ancestor but changed to survive in different islands)


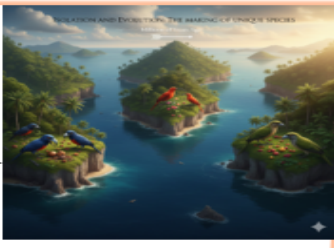



Figure 1 Prototype activity sheet

Figure 1 presents the prototype version of the developed activity sheet prior to the revisions suggested by the evaluators. The prototype activity sheet served as the initial model of the instructional material designed to facilitate students' understanding of evolutionary concepts through structured learning activities. It included the basic components of the lesson such as the learning objectives, activity instructions, and guide questions intended to promote students' engagement in the learning process. However, this preliminary version underwent further refinement based on the feedback of the thesis adviser and panel members to improve its organization, clarity of instructions, and alignment with the learning competencies. The prototype therefore functioned as the foundational version that guided the subsequent development and improvement of the final instructional material.

Prototype One: Face Validation

Draft Evaluation by the Thesis Adviser and Panel Members

After the completion of the initial draft of the instructional material, it was subjected to evaluation by a panel of experts and the researcher's thesis adviser. The purpose of this evaluation was to examine the quality, organization, relevance, and instructional effectiveness of the developed activity sheet prior to its implementation in the pilot testing phase (Richey & Klein, 2014; Schizas, Psillos, & Asimopoulos, 2024). This process allowed the validators to provide professional feedback on the structure, content alignment, clarity of instructions, integration of science process skills, and assessment strategies included in the material (Chabalengula, Mumba, & Mbewe, 2012; Nuha, Scisnayani, Supeno, & Wahyuni, 2023).

The panel and adviser carefully reviewed whether the material aligned with the prescribed curriculum standards and whether the activities were appropriate for the learners' level of understanding (Department of Education, 2024). They also examined the clarity of learning objectives, the organization of the material, and the effectiveness of activities in promoting inquiry-based learning and the development of science process skills (Byars-Winston, Estrada, Howard, Davis, & Zalapa, 2010; Schunk, 2012).

During the evaluation, the validators provided comments and suggestions for improving the instructional material. Recommendations focused on strengthening curriculum alignment, enhancing the integration of science process skills, improving clarity of instructions, and including more meaningful and contextualized learning activities (Driver, Asoko, Leach, Mortimer, & Scott, 1994; Pobiner, Beardsley, Bertka, & Watson, 2018). These suggestions formed the basis for revising and refining the material to ensure it met the standards of effective instructional design and science education (Richey & Klein, 2014). Table 4.3 presents the developmental revisions made in the instructional material based on the panel and adviser's recommendations. The table shows a comparison between the initial activity sheet version, the improved version, and the final developed version, along with the specific changes made in response to the validators' suggestions.

Table 4. Developmental Revision on Structure and Organization of the Instructional Material Based on the Evaluation of the Thesis Adviser and Panel Members

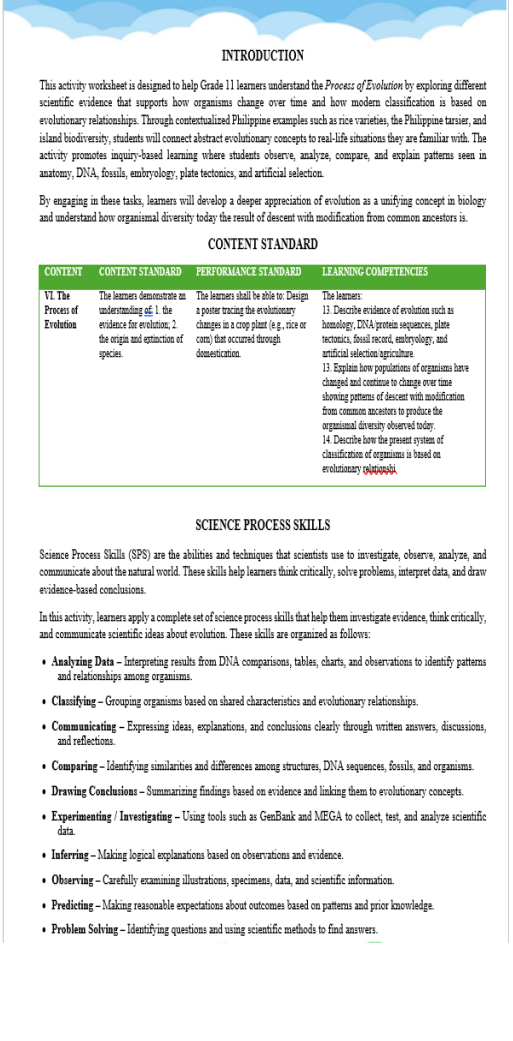
Before	Comment and Suggestion	After
<p>Subject: General Biology 1 Grade Level: 11 Time Allotment: 50 minutes Topic: Evidence of Evolution Setting: Philippines (local biodiversity, agriculture, and geography)</p> <p>Learning Targets</p> <p>At the end of the activity, you should be able to:</p> <ol style="list-style-type: none"> Describe different lines of evidence supporting evolution. Analyze and interpret scientific data and visuals. Relate evolutionary evidence to Philippine examples. Communicate conclusions using scientific reasoning. <p>Science Process Skills Focus</p> <ul style="list-style-type: none"> ✓ Observing ✓ Comparing ✓ Inferring ✓ Analyzing data ✓ Drawing conclusions ✓ Communicating findings <p>PART A. ENGAGE (5 minutes)</p> <p>Direction: Observe the images provided by your teacher or in this sheet.</p> <p>Guide Questions (Think-Pair-Share):</p> <ol style="list-style-type: none"> What similarities do you notice among the structures shown? Why do you think scientists compare DNA, fossils, and body structures when studying evolution? How might Philippine plants, animals, or landforms provide evidence of evolution? <hr/> <p>PART B. EXPLORE (25 minutes)</p> <p>Station-Based Group Investigation</p>	<p>Structure and Organization</p> <p>“The instructional material followed a simple activity sheet format with limited organization and repetitive sections”. (TP 1)</p> <p>“The activities were organized according to major evolutionary concepts such as evidence of evolution, descent with modification, and classification”. (TP 2)</p> <p>“Included a structured format consisting of an introduction, learning standards, organized activities, assessment rubrics, and supporting materials”. (TP 3)</p>	 <p>The screenshot shows a well-organized page with a blue header, an 'INTRODUCTION' section, a 'CONTENT STANDARD' table, and a 'SCIENCE PROCESS SKILLS' section. The table lists content standards, performance standards, and learning competencies for 'VI. The Process of Evolution'. The skills section includes a definition of SPS and a list of activities like Analyzing Data, Classifying, Communicating, Comparing, Drawing Conclusions, Experimenting/Investigating, Inferring, Observing, Predicting, and Problem Solving.</p>

Table 4 presents the developmental revision on the structure and organization of the instructional material based on the evaluation of the thesis adviser and panel members. Initially, the material followed a simple activity sheet format with limited organization and repetitive sections, which affected the clarity and flow of the learning

content. Based on the feedback of the evaluators, the structure of the material was improved by reorganizing the activities according to major evolutionary concepts such as evidence of evolution, descent with modification, and classification. Additional components, including an introduction, learning standards, assessment rubrics, and supporting materials, were also incorporated to make the instructional material more systematic and learner friendly. These improvements enhanced the overall organization of the material and ensured better alignment with the curriculum standards.

Table 5. Developmental Revision on Learning Objectives of the Instructional Material Based on the Evaluation of the Thesis Adviser and Panel Members

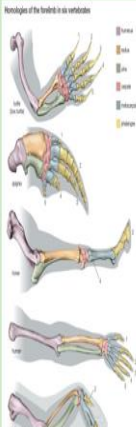
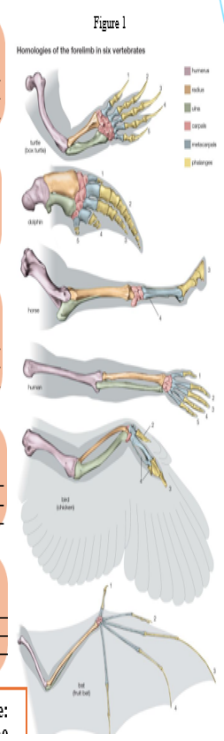
Before	Comment and Suggestion	After
<p>ACTIVITY SHEET</p> <p>Tracing Evolution in the Philippine Context</p> <p>Name: _____</p> <p>Grade and Section: _____</p> <p>Learning Targets At the end of this activity, you should be able to:</p> <ol style="list-style-type: none"> Describe different lines of evidence supporting evolution. Analyze and interpret scientific data and visuals. Relate evolutionary evidence to Philippine examples. Communicate conclusions using scientific reasoning. <p>Science Process Skills</p> <ul style="list-style-type: none"> ✓ Observing ✓ Comparing ✓ Inferring ✓ Analyzing data ✓ Drawing conclusions ✓ Communicating findings <p>PART A. ENGAGE (5 minutes) Direction: Observe the images provided by your teacher. Answer briefly.</p> <p>1. What similarities do you notice among the structures shown?</p> <p>3. Why do scientists compare DNA, fossils, and body structures when studying evolution?</p> <p>2. Give one example of a Philippine plant, animal, or landform that might show evidence of evolution.</p> 	<p>Learning Objectives</p> <p>“Learning objectives were stated in general terms and were not clearly connected to specific competencies”. (TP 1)</p> <p>“The objectives were revised to correspond with the activities included in the activity sheet”. (TP 2)</p> <p>“The objectives were clearly aligned with the content standards, performance standards, and learning competencies required in the curriculum”. (TP 3)</p>	<p>ACTIVITY WORKSHEET 1</p> <p>Tracing Evolution in the Philippine Context</p> <p>Name: _____</p> <p>Grade and Section: _____</p> <p>Date: _____ Score: _____</p> <p>Learning Targets At the end of this activity, you should be able to:</p> <ol style="list-style-type: none"> Describe the different evidence that support the theory of evolution. Analyze and interpret scientific data and visuals. Relate evolutionary evidence to Philippine examples. Communicate conclusions using scientific reasoning. <p>PART A. ENGAGE (10 minutes) Direction: Carefully observe the illustration showing the forelimb structures of different vertebrates (turtle, dolphin, horse, human, bird, and bat). Focus on the shape, arrangement, and type of bones. Answer the questions briefly.</p> <p>Figure 1 Homologies of the forelimb in six vertebrates</p>  <ol style="list-style-type: none"> What similarities do you notice among the structures shown in figure 1.? What bones appear to be common in all the forelimbs shown, even if their shapes and sizes are different? How are the forelimbs of the turtle, dolphin, horse, human, bird, and bat similar in structure but different in function? What do you think is the reason why these animals have similarity in structure but different in uses? Name a Philippine plant, animal, or landform that shows signs of change over time. <p>Science Process Skills Observing, Comparing, Classifying, Inferring.</p> <p>Score: _____</p>

Table 5 presents the developmental revision related to the learning objectives of the instructional material based on the evaluation of the thesis adviser and panel members. In the initial version, the learning objectives were written in general terms and were not clearly aligned with the specific curriculum competencies. Based on the suggestions of the evaluators, the learning objectives were revised to ensure stronger alignment with the content standards, performance standards, and learning competencies prescribed in the curriculum. The revised objectives were also linked directly to the activities included in the activity sheet to ensure coherence between the intended learning outcomes and the instructional tasks. These improvements strengthened the instructional design of the material and ensured that the activities effectively support the achievement of the targeted learning competencies.

Table 6. Developmental Revision on Integration of Science Process Skills in the Instructional Material

Before	Comment and Suggestion	After
	<p>Integration of Science Process Skills</p> <p>“Science process skills were mentioned but not clearly integrated into the activities”. (TP 1)</p> <p>“Some activities began to incorporate science process skills such as observation and data interpretation”. (TP 2)</p> <p>“Science process skills were systematically integrated into each activity to promote inquiry-based learning”. (TP 3)</p>	

Table 6 presents the developmental revisions related to the integration of science process skills in the instructional material. Initially, science process skills were only mentioned in the activities but were not clearly embedded within the learning tasks. Based on the suggestions of the thesis adviser and panel members, these skills were systematically integrated into each activity to ensure that learners actively practice observation, analysis, inference, and communication while studying evolutionary concepts. The integration of science process skills supports inquiry-based learning and enables students to engage in scientific investigation rather than simply memorizing information. As a result, the revised instructional material provides more meaningful learning experiences that strengthen both conceptual understanding and scientific skills.

Table 7. Developmental Revision on Clarity of Instructions in the Instructional Material

Before	Comment and Suggestion	After
<p>PART B. EXPLORE (25 minutes) Station-Based Group Investigation Write your answers based on your assigned station.</p> <p>Station 1: Homology (Comparative Anatomy) Compare the forelimbs of a bat, whale, human, and lizard.</p> <ol style="list-style-type: none"> 1. What similarities in bone arrangement did you observe? 2. What do these similarities suggest about ancestry? <p>Guide Answer: Similar structures support common ancestry because</p> <p>Station 2: DNA / Protein Sequences Data: Human-Tarsier DNA similarity ≈ 96%</p> <ol style="list-style-type: none"> 1. What does high DNA similarity indicate? 2. Why is DNA strong evidence of evolution? <p>Station 3: Plate Tectonics & Biogeography</p> <ol style="list-style-type: none"> 1. How can plate movement isolate species? 2. How does isolation lead to speciation? <p>Station 4: Fossil Record</p> <ol style="list-style-type: none"> 1. What do fossils tell us about ancient organisms? 2. Why are fossils called historical evidence of evolution? <p>Station 5: Embryology</p> <ol style="list-style-type: none"> 1. What similarities did you notice in embryos? 2. What does this suggest about ancestry? <p>Station 6: Artificial Selection</p> <ol style="list-style-type: none"> 1. How do humans change rice varieties like IR64 and Dinorado? 2. How is artificial selection related to natural selection? 	<p>Clarity of Instructions</p> <p>“Instructions were brief and sometimes repetitive, providing minimal guidance for students.” (TP 1)</p> <p>“Instructions were revised to improve clarity and reduce repetition” (TP 2)</p> <p>“Detailed and step-by-step instructions were included to guide students in performing the activities independently”. (TP 3)</p>	<p>PART B. EXPLORE (30 minutes) Station Adventure</p> <ul style="list-style-type: none"> Your group will visit different stations with their own pictures and activities. You can go in any order—just read the instructions at each station. Work together and write down your answers at each station. Have fun exploring! <p>Station 1: Homology (Comparative Anatomy) Compare the forelimbs of a bat, whale, human, and lizard.</p> <ol style="list-style-type: none"> 1. What similarities in bone arrangement did you observe? 2. What do these similarities suggest about ancestry? <p>Guide Answer: Similar structures support common ancestry because</p> <p>Station 2: DNA / Protein Sequences-Data: Human-Tarsier DNA similarity ≈ 96%</p> <ol style="list-style-type: none"> 1. What does high DNA similarity indicate? 2. Why is DNA strong evidence of evolution? <p>Station 3: Plate Tectonics & Biogeography</p> <ol style="list-style-type: none"> 1. How can plate movement isolate species? 2. How does isolation lead to speciation? <p>Station 4: Fossil Record</p> <ol style="list-style-type: none"> 1. What do fossils tell us about ancient organisms? 2. Why are fossils called historical evidence of evolution? <p>Station 5: Embryology</p> <ol style="list-style-type: none"> 1. What similarities did you notice in embryos? 2. What does this suggest about ancestry? <p>Station 6: Artificial Selection</p> <ol style="list-style-type: none"> 1. How do humans change rice varieties like IR64 and Dinorado? 2. How is artificial selection related to natural selection? <p style="text-align: right;">Score: /26</p> <p style="text-align: right;">Science Process Skills Observing, Experimenting, Investigating, Analyzing Data Communication, Problem Solving, Inferring</p>

Table 7 shows the developmental revisions related to the clarity of instructions in the instructional material. In the initial version, the instructions provided for the activities were brief and occasionally repetitive, which could cause confusion among learners. Based on the recommendations of the panel and thesis adviser, the instructions were revised to become clearer and more detailed. Step-by-step guidance was incorporated to help students understand the procedures and expectations of each activity. These improvements ensure that learners can perform the activities more effectively and independently, thereby supporting better engagement and understanding of the lesson.

Table 9. Developmental Revision on Assessment Strategies in the Instructional Material

Before	Comment and Suggestion	After																																								
<p>PART C. EXPLAIN (10 minutes) Direction: Complete the table below based on your investigation.</p> <table border="1" data-bbox="103 432 502 678"> <thead> <tr> <th>Organism Compared</th> <th>DNA Similarity (High / Moderate / Low)</th> <th>Evolutionary Relationship</th> <th>Classification Implication</th> </tr> </thead> <tbody> <tr> <td>Human - Tarsier</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Human - Monkey</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Human - Chicken</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p>PART D. ELABORATE (5 minutes) Individual Task: In 4-6 sentences, answer the question below: How does DNA evidence support the present system of classification of organisms? Use an example from the Philippine setting.</p> <div data-bbox="103 1025 502 1317" style="border: 1px solid black; border-radius: 15px; padding: 10px;"> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> </div> <p>PART E. EVALUATE & REFLECT (5 minutes) Reflection: Complete the statement. I learned that modern classification is based on _____ _____ This helps explain why organisms today are _____ _____</p>	Organism Compared	DNA Similarity (High / Moderate / Low)	Evolutionary Relationship	Classification Implication	Human - Tarsier				Human - Monkey				Human - Chicken				<p>Assessment Strategies</p> <p>“Assessment was limited to simple scoring and identification questions”. (TP 1)</p> <p>“Some structured questions and short-response tasks were included”. (TP 2)</p> <p>“The developed material incorporated various assessment tools such as rubrics, reflection questions, and performance tasks”. (TP 3)</p>	<p>PART C. EXPLAIN (10 minutes) Direction: Look at the results from Part B. Fill in the table by writing the level of relationship similarity for each pair of animals and explain what this tells you about how closely they are related.</p> <table border="1" data-bbox="949 499 1476 806"> <thead> <tr> <th>Animals Compared</th> <th>Relationship (Closely / Moderately / Distantly related)</th> <th>What does this tell you about their relationship?</th> </tr> </thead> <tbody> <tr> <td>Human - Monkey</td> <td></td> <td></td> </tr> <tr> <td>Human - Dog</td> <td></td> <td></td> </tr> <tr> <td>Human - Cat</td> <td></td> <td></td> </tr> <tr> <td>Human - Cow</td> <td></td> <td></td> </tr> <tr> <td>Human - Bat</td> <td></td> <td></td> </tr> <tr> <td>Human - Chicken</td> <td></td> <td></td> </tr> <tr> <td>Human - Fish</td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right;">Score: /21</p> <div data-bbox="933 828 1492 1310" style="border: 2px solid orange; border-radius: 15px; padding: 10px;"> <p>Guide Questions</p> <ol style="list-style-type: none"> Which animal is most closely related to humans based on your DNA comparison? _____ Which animal is most distantly related to humans? _____ How does DNA similarity show evolutionary relationships among organisms? _____ _____ How does this activity show that modern classification is based on evolutionary relationships rather than just physical appearance? _____ _____ _____ </div> <p>PART D. ELABORATE (5 minutes) Individual Task: In 3-5 sentences, answer the question below:</p> <div data-bbox="933 1478 1492 1758" style="border: 2px solid orange; border-radius: 15px; padding: 10px;"> <p>How did using GenBank (NCBI) and MEGA Software help you understand that the present system of classification of organisms is based on evolutionary relationships? Explain how comparing the same gene in different animals showed which organisms are more closely related.</p> <p>_____</p> <p>_____</p> <p>_____</p> </div> <p style="text-align: right;">Score: /6</p> <div data-bbox="1268 1321 1476 1400" style="border: 1px solid blue; padding: 2px;"> <p>Science Process Skills Analyzing Data, Comparing, Drawing Conclusions, Communicating, Inferring</p> </div>	Animals Compared	Relationship (Closely / Moderately / Distantly related)	What does this tell you about their relationship?	Human - Monkey			Human - Dog			Human - Cat			Human - Cow			Human - Bat			Human - Chicken			Human - Fish		
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Human - Chicken																																										
Human - Fish																																										

Table 9 shows the developmental revisions related to the assessment strategies used in the instructional material. In the initial version, assessment was limited to simple scoring activities and identification questions, which did not fully measure students’ understanding and skills. Based on the feedback of the evaluators, the assessment component was improved by including diverse evaluation methods such as rubrics, reflection questions, and performance-based tasks. These varied assessment strategies allow teachers to evaluate students’ conceptual understanding, scientific reasoning, and practical skills more effectively. Consequently, the revised assessment approach supports a more comprehensive evaluation of student learning.

Table 10. Developmental Revision on Contextualization of Learning Materials

Before	Comment and Suggestion	After
<p>PART A. ENGAGE (5 minutes) Direction: Read the situation below and answer the questions that follow.</p> <p>The Philippines is known for its rich biodiversity, with many unique organisms such as the Philippine eagle, tarsier, and various rice varieties. Although these organisms share similarities with species in other parts of the world, they also show distinct traits found only in the Philippines.</p> <ol style="list-style-type: none"> Why do you think Philippine organisms are both like and different from organisms in other countries? _____ What factors might cause populations of organisms to change over long periods of time? _____ <p>PART B. EXPLORE (20 minutes) Group Activity: Tracing Population Changes Direction: Work in groups. Read each scenario carefully and answer the questions.</p> <p>Scenario 1: Island Populations</p> <p>Millions of years ago, rising sea levels separated islands in the Philippines. A population of birds became isolated on different islands. Over time, these birds developed differences in beak size, feather color, and feeding behavior.</p> <ol style="list-style-type: none"> What caused the separation of the bird populations? _____ What changes occurred in the populations over time? _____ How do these changes show descent with modification? _____ 	<p>Contextualization of Learning Materials</p> <p>“Only a few examples related to local contexts were include”. (TP 1)</p> <p>“Additional examples connected to Philippine biodiversity were added”. (TP 2)</p> <p>“The final version incorporated contextualized examples such as rice domestication, island birds, and other local biological examples”. (TP 3)</p>	<p>PART A. ENGAGE (5 minutes) Direction: Read the paragraph about Philippine organisms. Then answer the question in your own words.</p> <p>The Philippines is known for its rich biodiversity, with many unique organisms such as the Philippine eagle, tarsier, and various rice varieties. Although these organisms share similarities with species in other parts of the world, they also show distinct traits found only in the Philippines.</p>  <ol style="list-style-type: none"> Why do you think Philippine organisms are both like and different from organisms in other countries? _____ What factors might cause populations of organisms to change over long periods of time? _____ <p>PART B. EXPLORE (30 minutes) Group Activity: Tracing Population Changes Direction: In your group, read each scenario about population changes. Discuss with your group and write down your answers for each question.</p> <p>Scenario 1: Island Populations</p>  <p>Millions of years ago, rising sea levels separated islands in the Philippines. A population of birds became isolated on different islands. Over time, these birds developed differences in beak size, feather color, and feeding <u>behavior</u>.</p> <ol style="list-style-type: none"> What caused the separation of the bird populations? (Example: a natural event that changed the land or sea). _____ What changes occurred in the populations over time? (Example: changes in body parts or behavior) _____ How do these changes show descent with modification? (Ex: birds came from the same ancestor but changed to survive in different islands) _____ <p style="text-align: right;">Score: /10</p>

Table 10 presents the developmental revisions related to the contextualization of the instructional material. In the initial version, only a few examples connected to the local context were included in the activities. Based on the suggestions of the evaluators, additional contextualized examples relevant to the Philippine environment were incorporated into the instructional material. These examples included topics such as rice domestication, island birds, and other forms of Philippine biodiversity. Incorporating local contexts helped make the learning material more meaningful and relatable to students, thereby enhancing their engagement and understanding of evolutionary concepts.

Table 11. Developmental Revision on Higher-Order Thinking Skills in the Instructional Material

Before	Comment and Suggestion	After
	<p>“Most questions focused on basic recall and identification of concepts”. (TP 1)</p> <p>“Some questions required explanation and analysis of concepts”. (TP 2)</p> <p>“The developed material included questions that encourage analysis, interpretation of evidence, and critical thinking”. (TP 3)</p>	

Table 11 presents the developmental revision related to the inclusion of higher-order thinking skills in the instructional material. In the initial version, most of the questions focused primarily on basic recall and identification of concepts, which limited opportunities for deeper cognitive engagement. Based on the suggestions of the evaluators, the questions were revised to incorporate higher-order thinking tasks such as analyzing scientific evidence, interpreting biological data, and explaining evolutionary concepts. These improvements encourage students to engage in critical thinking and apply their knowledge to scientific situations. As a result, the revised instructional material promotes deeper conceptual understanding and supports the development of advanced cognitive skills in learning evolutionary biology.

Table 12. Developmental Revision on Performance-Based Tasks in the Instructional Material

Before	Comment and Suggestion	After
	<p>“No clear performance task was included in the initial version”. (TP 1)</p> <p>“Some application tasks were introduced in the improved version”. (TP 2)</p> <p>“Included a performance task requiring students to design a poster illustrating evolutionary changes in a crop plant”. (TP 3)</p>	

Table 12 presents the developmental revision concerning the inclusion of performance-based tasks in the instructional material. In the initial version, the activity sheet did not contain a clear performance task that allowed students to apply their understanding of evolutionary concepts. Based on the recommendations of the panel and thesis adviser, a performance-based assessment was incorporated in the revised version. The task required students to design a poster illustrating the evolutionary changes in a crop plant through domestication. This activity encourages learners to apply scientific knowledge creatively while demonstrating their understanding of evolutionary processes. The inclusion of performance-based tasks strengthens authentic assessment and allows students to demonstrate their learning through meaningful and contextualized outputs.

The results indicate that the instructional material underwent substantial improvement during development. The initial version was simple and lacked a clear instructional structure. Constructive feedback from the panel and adviser resulted in a comprehensive, organized resource (Richey & Klein, 2014). Key improvements included the alignment of learning objectives with curriculum standards, systematic integration of science process skills into activities to support inquiry-based learning, incorporation of authentic scientific tools, and use of contextualized examples relevant to the Philippine setting (Ferguson et al., 2022; Pobiner et al., 2018). Additionally, enhancements in clarity of instructions, assessment strategies, and overall organization transformed the activity sheet into a structured instructional material that promotes conceptual understanding and scientific skills development (Nuha et al., 2023; Schunk, 2012).

Overall, the evaluation by the panel of experts and thesis adviser was instrumental in refining the instructional material and ensuring its quality before subsequent evaluation by teachers and school administrators and eventual implementation in the pilot testing phase (Richey & Klein, 2014; Department of Education, 2024).

PROTOTYPE Two: Validation of Panel of Evaluators

Evaluation by Teachers and School Principals

After the instructional material was revised based on the recommendations of the panel of experts and the thesis adviser, the improved version was subjected to further evaluation by selected science teachers and school principals. The purpose of this evaluation was to determine the quality, usability, and instructional suitability of the developed material when assessed by classroom practitioners and school administrators.

The evaluation of the instructional material was conducted using the Department of Education Evaluation Rating Sheet for Print Resources, which is a standardized instrument used to assess the quality of learning resources intended for classroom use. The evaluation tool measures several important aspects of instructional materials, including content quality, format, presentation and organization, and the accuracy and up-to-datedness of information.

The evaluators were asked to carefully examine the developed instructional material and rate each criterion using a four-point scale: 4 – Very Satisfactory, 3 – Satisfactory, 2 – Poor, and 1 – Not Satisfactory. Their ratings were collected and tabulated to determine the overall evaluation of the instructional material.

Table 13. Evaluator’s Rating of the Developed Activity Sheets in Evolution

Components	Mean	Description
Factor 1: Content		
1. Content is suitable to the learner’s level of development.	4.00	Very satisfactory
2. Material contributes to the achievement of specific objectives of the subject area and grade level for which it is intended.	3.83	Very satisfactory
3. Material provides for the development of higher cognitive skill such as critical thinking, creativity, learning by doing, inquiry problem solving, etc.	4.00	Very satisfactory
4. Material is free of ideological, cultural, religious, racial, and gender biases and prejudices.	3.83	Very satisfactory
5. Material enhances the development of desirable values and traits.	3.67	Very satisfactory

6. Material has the potential to arouse interest of target reader.	3.67	Very satisfactory
7. Adequate warning/cautionary notes are provided in topics and activities where safety and health are of concern.	4.00	Very satisfactory
Mean	3.86	Very satisfactory
Factor 2: Format		
1. Prints		
1.1 Size of letters is appropriate to the intended user.	3.67	Very satisfactory
1.2 Spaces between letters and words facilitate reading.	3.83	Very satisfactory
1.3 Font is easy to read.	4.00	Very satisfactory
1.4 Printing is of good quality (i.e., no broken letters, even density, correct alignment, properly placed screen registration).	3.83	Very satisfactory
2. Illustrations		
2.1 Simple and easily recognizable.	4.00	Very satisfactory
2.2 Clarify and supplement the text.	4.00	Very satisfactory
2.3 Properly labelled or captioned (if applicable)	3.83	Very satisfactory
2.4 Realistic/appropriate colors.	3.67	Very satisfactory
2.5 Attractive and appealing.	3.67	Very satisfactory
2.6 Culturally relevant.	3.67	Very satisfactory
3. Design and Layout		
3.1 Attractive and pleasing to look at.	3.67	Very satisfactory
3.2 Simple (i.e., does not distract the attention of the reader).	3.83	Very satisfactory
3.3 Adequate illustration in relation to text.	4.00	Very satisfactory
3.4 Harmonious blending of elements (e.g., illustrations and text).	4.00	Very satisfactory
4. Paper and Binding		
4.1 paper used contributes to easy reading	3.83	Very satisfactory
4.2 Durable binding to withstand frequent use	3.50	Very satisfactory
5. Size and Weight of Resource		
5.1 Easy to handle	4.00	Very satisfactory
5.2 Relatively light	4.00	Very satisfactory
Mean	3.83	Very satisfactory
Factor 3. Presentation and Organization		
1. Presentation is engaging, interesting, and understandable.	3.83	Very satisfactory
2. There is logical and smooth flow of ideas.	4.00	Very satisfactory
3. Vocabulary	3.67	Very satisfactory
4. Length of sentences is suited to the comprehension and interesting to the target reader.	3.83	Very satisfactory
5. Sentences	3.83	Very satisfactory
Mean	3.83	Very satisfactory
Factor 4. Accuracy and Up-to-datedness of Information		
1. Conceptual errors	4.00	Not present
2. Factual errors	4.00	Not present
3. Grammatical errors	4.00	Not present
4. Computational errors	4.00	Not present
5. Obsolete information	4.00	Not present
6. Typographical and other minor errors	4.00	Not present
Mean	4.00	Not present

Legend (factor 4): 1.00-1.74 (poor); 1.75-2.49 (present & requires major re-development); 2.50-3.24 (present but very minor & must be fixed); 3.25-4.00 (not present)

Table 13 presents the evaluators' rating of the developed activity sheet in Evolution based on content, format, presentation and organization, and accuracy of information. The results show that the activity sheet obtained an overall very satisfactory rating across the first three factors, with a mean of 3.86 for content, 3.83 for format, and 3.83 for presentation and organization, indicating that the material is appropriate for the learners' developmental level, supports the achievement of subject objectives, and promotes higher-order thinking skills such as inquiry and problem solving. In addition, the activity sheet obtained a perfect mean score of 4.00 for accuracy and up-to-datedness of information, which indicates that conceptual, factual, grammatical, and typographical errors were not present in the material. These findings suggest that the developed instructional material is well-structured, accurate, and suitable for classroom implementation in teaching evolutionary biology.

The results shown in Table 13 indicate that the developed activity activity sheet in Evolution was evaluated as very satisfactory in terms of content, format, and presentation and organization. The content component obtained a mean score of 3.86, indicating that the material is appropriate for the learners' developmental level and contributes to the achievement of the intended learning objectives. Moreover, the evaluators recognized that the material promotes the development of higher-order cognitive skills such as inquiry, critical thinking, and problem solving. Instructional materials that encourage inquiry-based learning are essential in science education because they help students actively construct knowledge and engage in scientific investigation (Driver, Asoko, Leach, Mortimer, & Scott, 1994). Similarly, integrating activities that develop science process skills enables learners to better understand scientific concepts and apply them in real-life contexts (Chabalengula, Mumba, & Mbewe, 2012).

In terms of format, the activity sheet received a mean rating of 3.83, which is interpreted as very satisfactory. This indicates that the layout, font style, spacing, illustrations, and overall design were appropriate and easy to understand for the intended users. Well-designed instructional materials play an important role in facilitating effective learning because clear formatting, readable text, and relevant illustrations support students' comprehension of scientific concepts (Nuha, Scisnayani, Supeno, & Wahyuni, 2023). The presentation and organization of the material also received a mean score of 3.83, suggesting that the ideas were logically arranged and presented in a clear and engaging manner. Logical sequencing of concepts and appropriate language use are important elements of instructional design because they help learners follow the progression of ideas and develop deeper understanding of the lesson (Schunk, 2012).

Furthermore, the factor on accuracy and up-to-datedness of information obtained a perfect mean score of 4.00, indicating that conceptual, factual, grammatical, and typographical errors were not present in the developed material. This result suggests that the activity sheet contains reliable and accurate scientific information appropriate for teaching evolutionary biology. Ensuring the accuracy of scientific concepts is a crucial requirement in science instructional materials because misconceptions can hinder students' understanding of fundamental biological principles (Bertka, Pobiner, Beardsley, & Watson, 2019). Overall, the evaluation results demonstrate that the developed activity sheet is a high-quality instructional resource that can effectively support the teaching and learning of evolution while promoting students' inquiry skills and conceptual understanding.

CONCLUSION

This study successfully developed and evaluated an inquiry-based activity sheet on the topic of evolution aligned with the Grade 11 Earth and Life Science curriculum. The development process, which involved curriculum mapping, systematic design, expert validation, and evaluation by teachers and school administrators, ensured that the instructional material was grounded in curriculum standards and principles of effective instructional design.

The results of the evaluation revealed that the developed activity sheet attained an overall very satisfactory rating across key components, including content, format, and presentation and organization, while demonstrating a high level of accuracy and up-to-datedness of information. These findings indicate that the material is appropriate for learners' developmental level, supports the achievement of intended learning competencies, and promotes higher-order thinking skills such as inquiry, critical thinking, and problem solving. The integration of science process skills and the inclusion of structured, inquiry-based activities further strengthen the instructional value of the material.

Moreover, the validation process played a crucial role in refining the instructional material. Feedback from experts and evaluators led to significant improvements in the organization, clarity of instructions, alignment of learning objectives with competencies, incorporation of authentic scientific tools, contextualization of examples, and enhancement of assessment strategies. These revisions contributed to the development of a more comprehensive, learner-centered, and pedagogically sound instructional resource.

Overall, the findings of the study demonstrate that the developed activity sheet is a valid, well-structured, and high-quality instructional material that is suitable for use in teaching evolutionary biology. While the study did not involve classroom implementation, the positive evaluation results suggest that the material has strong potential to support effective teaching and learning. Future studies may consider implementing the instructional material in actual classroom settings to further examine its impact on students' conceptual understanding and science process skills.

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