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Design, Development, and Validation of Panag-on Eco Book: An Instructional Material in Teaching Climate Change and Biodiversity

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Abstract: As climate change reshapes our world, it is increasingly important to ground science education in the local context, transforming abstracts risks like biodiversity loss into tangible realities for Filipino students. This study focused on the development and validation of the Panag-on Eco Book, a localized instructional material designed to enhance the environmental literacy of Grade 11 learners. Utilizing research and development design, the study employed the Analysis, Design, Development, and Evaluation (ADDE) Model reinforced with Taba's Grassroot Approach, ensuring that the instructional material was built upon the actual classroom needs and local environmental realities of the province. The study revealed that while learners have a basic awareness of environmental issues, there is a demand for improvement particularly on the analysis of specific biological impacts on local ecosystems. Moreover, instructional objectives were mapped on the new curriculum guide for General Science specifically for competencies that covers Philippine Ecosystem and use ADDE model as the framework for creating instructional material. The material was contextualized through the selection of localized environmental contexts specific to a certain province. Expert evaluation using the DepEd Learning Resource Evaluation Tool resulted in "Excellent" ratings across content quality and organizational flow. The result confirms that the Panag-on Eco Book is a highly valid resource, effectively bridging the gap between global scientific theories and local ecological conservation. This research highlights the effectiveness of learner-centered and localized innovation in enhancing learner engagement and environmental stewardship.

Keywords: *Science Education, Panag-on Eco Book, Climate change, ADDE Model, Developmental Research Design, Central Philippines.*

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I. INTRODUCTION

Efforts to bridge the gap between theoretical knowledge and pressing global issues have led to a profound transformation in science education practices across the globe as emphasized by the Organisation for Economic Co-operation and Development (2025). This change highlights the growing need for innovative, learner-centered, and context-based instructional strategies, supported by effective teaching materials, to strengthen scientific literacy and enhance learners' practical problem-solving skill.

Significantly, climate change is an inter-governmental complex challenge globally with its influence over various components of the ecological, environmental, socio-political, and socio-economic disciplines (Abbass et al., 2022). It is a global threat that has embarked on to put stress on various sectors, including in education. Climate change has significantly affected not only rural areas but also in numerous ecosystems which effects are on coral bleaching, mangrove degradation, and disruption of essential functions such as fishing industry and flood prevention, as evidenced in the study by Fourqurean et al. (2023) and supported by Bulleri et al. (2018).

The Philippine biodiversity is one of the most exceptional around the world. It possesses a diverse species of plants and animals (Agduma et al., 2023). However, the country's biodiversity is currently threatened by a lack of public awareness, governance challenges, and gaps in research and knowledge management due to limited expertise in the field of biodiversity (Pitchay and Torrentira, 2022). Recent literature recognizes that integrating indigenous and local knowledge with scientific framework is essential for developing culturally relevant climate change mitigation

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strategies that empower vulnerable communities to navigate environmental challenges (Dorji, 2024).

Climate change significantly affects the Philippines and is regarded as a crisis. In the field of education, the impacts of climate change are evident. Rising temperatures create discomfort for both learners and teachers, making instruction more difficult in hot environments. Moreover, when the heat index exceeds 40 degrees, classes may be disrupted or suspended altogether. This demand sparks the idea of the inclusion of the Philippine ecosystems as one of the topics in the senior high school curriculum with the aim to allow learners to understand the country's unique biological systems and their responses to environmental challenges (Sales et al., 2022). With the recent update on the Grade 11 General Science Curriculum, it formed a gap and an opportunity to make the learners aware of the status of the Philippines in relation to climate change by highlighting localized area. With this action, it may offer locally relevant solution, as research shows that contextualized materials enhance students' engagement and comprehension in science education (Rahmah and Risnani, 2023).

Aligned with the updated Grade 11 General Science curriculum, the topic on Philippine ecosystem emphasizes key learning competencies such as describing what is meant by the term climate change, describing how biological systems responds to climate change and contribute to understanding its effect on living organisms in the Philippines, and explaining how climate change impacts Philippine ecosystem. These competencies underscore the need for instructional materials that are scientifically accurate, curriculum-aligned, and grounded in the local environmental context (Genizera et al., 2022).

In response to this need, the Panag-on Eco Book was developed as localized and contextualized instructional material designed to support teaching of climate change and biodiversity. It is acknowledged that changes in learning and teaching methodologies have resulted from the tremendous advancement in technology and the demand for creative means of delivering education (Ong & Bonganciso, 2024). Recent studies identify resilience and adaptive capacity as fundamental pillars, rather than secondary considerations, in the pursuit of climate change education and biodiversity conservation. These concepts provide critical frameworks for equipping communities to withstand environmental stressors and foster long-term sustainability (Gilead, 2026; Oktaviani and Masjud, 2024). Research indicates that contextualized learning models can effectively integrate scientific theory to local environmental issues, particularly in high-risk areas. By integrating leaners' everyday experience with topics related to climate change, these models enhance understanding complex ecological systems and improve overall academic performance (Nacionales, 2025; Pan et. al., 2023).

The term Panag-on which means resilience and recovery, reflects the core theme of this material and understanding how biodiversity and living organisms respond and adapt to environmental change. The Eco Book integrates indigenous knowledge systems on environmental practices that promote stability and biodiversity conservation. As a curriculum-aligned instructional material, the Panag-on Eco Book serves as a practical learning resource for educators and learners in enhancing environmental education, enabling curriculum application, and fostering a community awareness of sustainable practices.

The study aimed to design, develop, and evaluate Panag-on Ecobook as a learning material in teaching climate change and biodiversity. It specifically sought to answer the following questions. What is the needs analysis for developing the instructional material?, What model could be used to design the instructional material?, What could be developed to enhance the conceptual understanding of Grade 11 learners?, and What are the results of the evaluation phase to enhance the conceptual understanding of learners in climate change and biodiversity?

II. METHODOLOGY

A. Design

The study utilized a developmental research design centered on systematic creation and evaluation of an instructional material aligned with the Grade 11 General Science curriculum, particularly on climate change and biodiversity. Developmental research design, formalized by Richey and Klein (1994), is defined as a systematic approach focused on design, development, and evaluation of instructional processes or products to ensure effectiveness and relevance. This approach emphasizes generating empirical foundations for creating and improving instructional materials or models through iterative development and assessment process (Jaya, 2021).

The use of this design is appropriate to the study primarily as it focuses on the systematic creation, validation and refinement of instructional materials, ensuring that the developed Eco Book directly addresses identified learning gaps and aligns with the curriculum standards. This approach is suitable as it allows rigid development and evaluation, which enhances the quality, usability, and effectiveness of educational materials in real classroom context (Balbin et al., 2025). It is viewed as a structured and cyclical process that integrates analysis, design, development, and evaluation to produce practical solutions and theoretical insights, as highlighted in recent educational research (Tatari et al., 2025).

B. Sources of Data

The sources of the data of this study consisted of Grade 11 learners and three evaluators who are deemed to be learning resource experts. A total of 50 Grade 11 learners served as respondents for a researcher-made diagnostic test, which was administered to identify learning gaps and determine the specific topics and subtopics to be emphasized in the development of the Panag-on Eco Book.

In addition, three learning resource expert evaluators provided evaluative data for the study. These evaluators possessed extensive experience in the development and assessment of instructional materials and have undergone formal training in the evaluation of learning resources. The

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panel included a Learning Resource Management specialist that assessed the overall concept of the Eco Book to ensure the material achieved full alignment with the Department of Education standards and the content is appropriate and suitable for learners to use. Second, a content expert in science, whose role was to verify the scientific accuracy and conceptual depth of the ecological topics, which is crucial for maintaining the academic integrity of the material. Lastly, one expert evaluator focused on grammar and technicalities, serving the vital purpose of ensuring linguistic clarity and professional formatting to prevent any cognitive barriers for the learners. Their collective expertise ensured a comprehensive and standards-based evaluation of the Panag-on Eco Book using the Department of Education Learning Resource Evaluation Tool.

C. Locale

The study was conducted in a public secondary high school in an urbanized city in the Central Philippines during the Academic Year 2025-2026. The research was set within a learning community committed to academic excellence, delivering quality education through a curriculum-aligned and research-based approach intended to produce learners that are both locally grounded and globally competitive.

D. Instsrument

This study employed two research instruments to support the development and evaluation of the Panag-on Eco Book through a researcher-made diagnostic test and the Evaluation Rating Sheet for Print Resources under the Department of Education's Learning Resource Management and Development System (LRMDS).

The researcher-made diagnostic test was developed in alignment with the Grade 11 General Science curriculum, with focus on the newly introduced learning competencies under the Philippine ecosystem topic. The instrument comprised with a 30- item multiple choice test, which was systematically organized. The test items were constructed based on the identified topics and subtopics specified in the updated curriculum guide, with each learning competency allocated 10 items ensuring direct alignment with competencies related to climate change and its impact on Philippine biodiversity. Prior to test construction, a Table of Specification (TOS) was prepared to systematically map the learning competencies to the corresponding number and cognitive level of test items. Thereby ensuring balanced and representative content coverage. To establish content validity, the diagnostic test underwent expert validation by experts in science education. This validation process ensured that the test items were accurate, clearly stated, and appropriately aligned with the intended learning competencies before administration to the learners.

The second instrument utilized in the study was the Evaluation Rating Sheet for the Print Resource, a standardized evaluation tool prescribed by the Department of Education through the LRMDS for assessing the quality of instructional materials intended for classroom use. This evaluation tool utilized a four-point Likert scale to assess print resources across key criteria with particular emphasis on content and format. The content criterion evaluated the accuracy of scientific information, alignment with curriculum standards, development appropriateness for Grade 11 learners, promotion of inquiry and critical thinking, absence of bias, integration of positive values, learner engagement, and inclusion of appropriate safety considerations. In accordance with Department of Education standards, instructional materials had to obtain a minimum score of 21 out of 28 points under this criterion to be considered acceptable.

The format criterion focuses on the physical and visual attributes of the instructional material to ensure readability, usability, and durability. This includes the assessment of print quality, illustrations, design and layout, paper and binding, and size and weight. Evaluators examine whether the font style and spacing enhance readability, illustrations were relevant, culturally appropriate, and supportive of the text, and the overall layout effectively integrates visual and textual elements without causing distractions. The durability of the material and its manageability for learners were also considered. To meet the Department of Education requirements, instructional materials had to achieve a minimum score of 54 out of 72 points under the format-related criteria. In this study, the Evaluation Rating Sheet for Print Resources served as the primary tool for expert validation, ensuring that the Panag-on Eco Book met national standards for quality, accuracy, and curriculum alignment prior to instructional use.

E. Data Collection Procedure

Prior to conducting the study, the researcher obtained permission from the appropriate authorities. The instructional material was aligned with the new Grade 11 General Science curriculum guide and was developed in line with the Analysis, Design, Development, and Evaluation (ADDE) approach. Experts reviewed the instructional material utilizing the DepEd Evaluation Rating Sheet for Print Resources.

During the Analysis Phase, a careful review of the Strengthened Senior High School Curriculum in Geneal Science was conducted to identify newly implemented competencies. To further determine learner's needs and learning gaps, a researcher-made diagnostic was administered to Grade 11 students. The result of the diagnostic tests was used as the basis for identifying the key topics and subtopics to be included in the development of the Panag-on Eco Book.

For the Design Phase, a researcher made-diagnostic test was given to Grade 11 students. The diagnostic test was aligned with the new curriculum guide for General Science in Grade 11 that covers newly introduced topics such as Philippine biodiversity and climate change. Prior to its implementation, the diagnostic test was subjected to expert validation to ensure its accuracy, clarity, alignment with the intended competencies. Learning objectives were then formulated based on the competencies, and the content organized in a coherent manner. Appropriate instructional strategies, learning activities, and assessment tasks were made to ensure that the material supported learner's

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conceptual understanding and engagement. The layout and structure of the Eco Book was also planned to ensure clarity, organization, and contextual relevance.

In the Development Phase, the Panag-on Eco Book was developed by incorporating localized and contextualized content based on Philippine biodiversity and climate change. The material included illustrations, inquiry-based activities, guide questions, and formative assessments to support meaningful learning. Draft versions of the Eco Book were produced and reviewed to ensure accuracy, readability, and alignment with the intended learning objective and learning competencies.

For the Evaluation Phase, the developed Eco Book was submitted to learning resource expert evaluators for validation using the Learning Resource Evaluation Tool. Evaluators assessed the instructional material in terms of accuracy, format, presentation, organization, and alignment with curriculum standards. The ratings, comments, and suggestions provided by the evaluators were collected and served as the basis for revising and improving the Panag-on Eco Book to ensure its quality, relevance, and effectiveness for instructional use.

F. Data Analysis

The data were analyzed based on the researcher-made diagnostic test, which served as the basis for determining the reliability of the instrument and identifying learners' conceptual gaps. The findings obtained from the item analysis and reliability testing provided evidence of the test's consistency and guided the selection of key topics and subtopics to be emphasized in the instructional material. Furthermore, the evaluation results of the Panag-on Eco Book, as assessed by the evaluators using the Learning Resource Evaluation Tool, served as the basis for determining its overall quality. In relation to this, the LRMDS guidelines for print resources were applied to ensure that the developed instructional material met the required educational, legal, and technical standards. The evaluation followed a structure and criteria-based approach using a standardized rating sheet, wherein each indicator was rated using a four-point scale: 4 (excellent), 3 (very good), 2 (Fair), and 1 (Poor). The instructional material was evaluated across key criteria such as content and format, with a maximum score of 28 points for content and 72 points for format. In accordance with the DepEd standards, the material needed to obtain a minimum score of 21 out of 28 in content and 54 out of 72 for format to be considered acceptable. Failure to meet the required minimum score in any of the criteria indicated the need for revision. Through this process, the Panag-on Eco Book was confirmed to be accurate, well-organized, and aligned with the intended learning competencies.

III. RESULTS

This chapter presents and discusses the results of the study in relation to the research problems. It includes the analysis and interpretation of the data gathered from the diagnostic tests, emphasizing learners' performance and identifying areas of difficulty. The findings are discussed in relation to ADDE instructional design, which consists of the phases of analysis, design, development, and evaluation.

A. Analysis of Panag-on Eco Book

The implementation of the Strengthened Senior High School (SSHS) Curriculum by the Department of Education introduced significant revisions in context, particularly in science education, where competencies on climate change and Philippine biodiversity was emphasized. These changes required learners to engage with more complex, contextualized, and higher-order concepts, thereby creating a demand for instructional materials that are aligned with the updated curriculum guide (Samilo, 2025). Existing resources were found to be insufficient in addressing these new competencies, particularly in terms of localization and application of real-life environmental contexts (Banzuelo and Quiñones, 2026; Bello et al., 2023). Consequently, the development of the Panag-on Eco Book was needed to support effective curriculum implementation and enhance learner's conceptual understanding. The analysis phase determined the learner's prior knowledge and identified existing learning gaps in relation to the competencies on climate change and Philippine biodiversity. This was carried out through the administration of the researcher-made diagnostic test aligned with the updated curriculum.

Table 1. Learner's Prior Knowledge on Climate Change and Philippine Biodiversity

Learning Competency	Mean Percentage Score	Interpretation
Describe what is meant by the term climate change	75%	Average
Describe how biological systems respond to climate change and contribute to understanding its effects on living organisms in the Philippines	68%	Average
Explain how climate change impacts Philippine ecosystems	62%	Low
Overall	68%	Average

As reflected in Table 1, learners obtained the highest mean percentage score in describing what is meant by climate change (75%), indicating that learners possess a foundational understanding of the concept. However, lower mean score was observed in describing how biological systems respond to climate change (68%), suggesting a moderate understanding with difficulty explaining processes. The lowest mean percentage score (62%) was recorded in explaining how climate change impacts Philippine ecosystems, indicating challenges in higher-order thinking skills such as application and analysis. These findings highlight the presence of learning gaps, particularly in competencies that require deeper conceptual understanding and contextual application. With the implementation of the strengthened SHS curriculum, the need for curriculum-aligned instructional materials becomes evident. The limited availability of localized and contextualized resources further emphasizes this need. Hence, the development of the instructional material is necessary to

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address these gaps, support learners' understanding and ensure effective delivery of the revised curriculum.

Studies on environmental education shows that, although climate change concepts are integrated into the curriculum, challenges such as limited instructional resources, insufficient teacher preparation, and gaps in curriculum implementation continue to hinder effective learning (Cruz-Ocampo, 2025; Macasinag, 2021). These challenges result in gaps in students' knowledge, attitudes, and application of climate change concepts, thereby highlighting the need for improved and appropriate instructional support (Bercasio et al., 2021).

Furthermore, the implementation of the strengthened senior high school curriculum has been challenged by lack of adequate instructional materials, as teacher are often required to deliver lessons despite the limited resources, outdated materials, and insufficient support systems, which negatively affect instructional quality and student learning (Palorma, 2025). According to Nacionales (2025), the absence of contextualized instructional material makes it difficult for learners to fully understand and apply concepts, emphasizing the need to develop localized and competency-based learning resources to address these gaps and improve learners' conceptual understanding.

B. Design of Panag-on Eco Book

Following the results of the diagnostic test that served as a basis for structuring the content of Panag-on Eco Book in the analysis phase, in which the result shows specific learning gaps in areas such as climate change concepts, biological and physiological responses, and ecosystem impacts. These findings guided the prioritization of topics and subtopics identified in the Table of Specifications, ensuring that the competencies with lower mean scores received greater emphasis in the development of lessons and learning materials.

The integration of Taba's Grassroot Approach further strengthened this alignment during the design phase by focusing on content that directly addresses the learning gaps identified in the analysis phase. This methodology guided the design of Panag-on Eco Book, aligning it with the established curriculum while also addressing the specific needs of the learners. Taba (1962) emphasized that curriculum development should be based on solid evidence of learners' challenges before setting goals. This approach ensures teaching objectives are relevant to the context, helping students connect abstract scientific concepts to everyday experiences with the environment.

The integration of Taba's Grassroot Approach further strengthened this alignment during the design phase by focusing on content that directly addresses the learning gaps identified in the analysis phase. This methodology guided the design of Panag-on Eco Book, aligning it with the established curriculum while also addressing the specific needs of the learners. Taba (1962) emphasized that curriculum development should be based on solid evidence of learners' challenges before setting goals. This approach ensures teaching objectives are relevant to the context, helping students connect abstract scientific concepts to everyday experiences with the environment.

The term Tinutuyo is a Hiligaynon word that refers to one's purpose, intention or goal, which conceptually corresponds to instructional objectives in educational contexts. In this study, the term was deliberately used as an alternative to objectives to localize Panag-on Eco Book and make the learning process more culturally relevant and meaningful to learners. This section defines the intended learning outcomes of each lesson in clear, specific, and measurable terms aligned with the Grade 11 General Science competencies. Objectives were formulated based on the results of the diagnostic test and the identified learning gaps, particularly focusing on competencies where learners demonstrated lower levels of understanding. By grounding the objectives on empirical data from the analysis phase, the Eco Book ensures that the instruction is responsive and targeted, and relevant to learner's actual needs.

In this study, the use of Hunahuna-a, a term that refers to one's initial understanding that corresponds to the introductory discussion of each lesson in the Panag-on Eco Book, was adopted to localize the instructional material and make the presentation of scientific concepts more relatable and meaningful to learners. This section establishes the foundational context of each lesson by bridging prior knowledge with new information aligned with competencies. The content was formulated based on the results of the diagnostic test and the identified learning gaps, particularly focusing on complex topics where learners demonstrated lower levels of performance. By grounding the lesson overview on empirical data from the analysis phase, the Eco Book ensures that the introductory discussion is responsive, targeted, and relevant to the learners' actual conceptual needs.

The Eco Book also includes a part titled Buluhaton. The section Buluhaton in this study contains structured learning activities that promote engagement, inquiry, and application of concepts. In Hiligaynon Buluhaton is a term for task, duty or activity, a word that refers to something that needs to be done. Using it as a term for activities reflects a localized and culturally responsive approach, making the Eco Book more contextualized. In the Eco Book, this section is designed using inquiry-based and collaborative approaches, where learners participate in group discussions, role-playing, and problem-solving tasks grounded in real-life and localized environmental scenarios in the Philippines and Negros Occidental. These activities are intentionally aligned with inquiry-based instructions, which encourages learners to explore, question, and construct knowledge through experience. Also, the integration of indigenous knowledge and community-based practices allows learners to connect scientific concepts with long-established local understandings of environmental changes, enhancing relevance and contextual learning. These activities will bridge theory and real-life situations, helping learners apply concepts on climate change and biodiversity while developing critical thinking and participation skills.

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Assessment was termed Pagtakus in the Eco Book, as the word refers to an act of testing, estimating, or judging one's ability or knowledge, which aligns to concept of evaluation or assessment. This part measures or determines learners' level of understanding. The Taya section contains assessment tools, primarily in the form of a multiple-choice test, aimed at measuring learner's conceptual understanding of each lesson. These assessments are aligned with the stated objectives and learning competencies. Questions included are not limited to simple recall but are designed to evaluate learners' higher order thinking skills such as application, analysis, and evaluation. This aligns with Blooms Taxonomy, where well-constructed multiple-choice questions can measure deeper understanding and critical thinking rather than memorization. This approach strengthens the quality of the assessment and ensures that it effectively measures learners' knowledge and ability to apply concepts related to climate change and biodiversity.

References also labeled as Tinubdan compile all the sources used in developing the Eco Book to ensure the accuracy and credibility of the content. Tinubdan is a Hiligaynon word that means source, origin, or foundation. As used in Eco Book, Tinubdan compile all the sources used in developing the Eco Book to ensure the accuracy and credibility of the content. These are drawn from reliable scientific and educational materials to support the validity of the instructional material. The inclusion of reference is important because it ensures that the information presented is evidence-based, accurate, and aligned with the accepted scientific knowledge, thereby strengthening the quality of the material.

C. Development of Panag-on Eco Book

In the Development Phase, the Panag-on Eco Book was systematically developed as a localized and contextualized instructional material in response to the newly implemented General Science curriculum in Senior High School, which introduced new competencies on climate change and Philippine biodiversity. The emergence of these updated competencies revealed a gap in the availability of instructional materials that are aligned, localized, and responsive to learners' needs.

In this study, the development of a localized, inquiry-based Eco Book incorporating interactive activities, real-life applications, and formative assessments serves as an effective instructional material to enhance learners' conceptual understanding. Such materials promote active participation, learner autonomy, and connections between scientific concepts and real-world contexts, thereby supporting deeper and more sustained learning.

Overall, the Eco Book was developed using inquiry-based learning strategies, allowing learners to actively engage in exploring concepts, examining real-life environmental issues, and constructing knowledge through meaningful experience. Studies indicate that inquiry-based instructional materials significantly improve learners' conceptual understanding, particularly in science education, by promoting deeper engagement with content (Mediana et al., 2025). Likewise, inquiry-based approaches encourage critical thinking, problem-solving, and evidence-based reasoning as learners are guided to investigate, question, and analyze information.

D. Evaluation of Panag-on Eco Book

The instructional material was assessed by subject matter experts to guarantee its pedagogical efficacy and alignment with the new General Science curriculum. As presented in Table 3, it revealed the evaluation result for the Panag-on Eco Book in terms of content. As shown in the table, the material's developmental suitability, alignment with subject objectives, and promotion of higher-order thinking skills, alongside its adherence to social standards, integration of desirable values, and potential to engage the target readers were given a mean rating of 4, which is interpreted as "Excellent", while the provision of adequate safety and health warnings received a mean of 3.33, which is also described as "Excellent".

Table 2. Evaluation Result of the Panag-on Ecobook as to Content

Factor 1: Content	**Mean**	**Description**
1. Content is suitable for the learner's level of development.	4	Excellent
2. Material contributes to the achievement of specific objectives of the subject area and grade/year level for which it is intended.	4	Excellent
3. Material provides for the development of higher cognitive skills such as critical thinking, creativity, learning by doing, inquiry, problem solving, etc.	4	Excellent
4. Material is free of ideological, cultural, religious, racial, and gender biases and prejudices.	4	Excellent
5.Material enhances the development of desirable values and traits such as: (Put a check (√) mark only to the applicable values and traits)	4	Excellent
6. Material has the potential to arouse interest of target reader.	4	Excellent
7. Adequate warning/cautionary notes are provided in topics and activities where safety and health are of concern.	3.33	Excellent
Total	**27.3**	**Passed**

These results indicate that the material has met the standards and descriptors set for content evaluation. Based on the Department of Education's LRMDS criteria, a print instructional material is considered acceptable when it satisfies the required ratings, implying that the content is appropriate, sufficient, and aligned with the learning competencies of the intended learners.

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Criterion 2 obtained a mean rating of 4, indicating that the evaluators strongly agreed that the Eco Book effectively supports the attainment of learning objectives and aligns with the intended competencies for the subject and grade level. This suggests that the material contributes to reinforcing and deepening understanding of key concepts. Since the instructional material plays a crucial role in achieving educational goals, careful alignment with objectives is essential (Dumale and Gurat, 2023). According to Lacanilao and Manalastas (2023), well-developed instructional materials significantly enhance mastery of competencies when it is directly anchored on curriculum standards.

For criterion 3 that obtained a mean score of 4, implies that the material effectively promotes higher-order thinking skills such as analysis, critical thinking, and problem-solving. This indicates that the Eco Book goes beyond basic knowledge acquisition and encourages deeper cognitive engagement. Research highlights that instructional materials designed with activities targeting higher-order thinking can significantly improve learners' analytical and problem-solving abilities (Sulatra, 2022; Andriani et al., 2024).

Criterion 4 has a mean score of 4, reflecting that the material is free from bias and presents content in a fair and inclusive manner. This ensures that the learners are exposed to balanced and culturally appropriate information, which is essential in maintaining the integrity of instructional resources (Safitri et al., 2025; Sumardi et al., 2025).

Criterion 5 obtained a mean of 4, this indicates that the Eco Book supports the development of positive values and desirable traits among learners. Instructional materials that integrate value formation contribute not only to cognitive development but also to learners' holistic growth. Supporting literature affirms that well-designed learning materials can influence both academic and character development (Camuyong, 2023).

Criterion 6 obtained a mean rating of 4, suggesting that the material is engaging and relevant to learners' experiences. This indicates that the Eco Book is capable of capturing students' interest and sustaining their attention throughout the learning process. Effective instructional materials are those that connect with learner's context and promote active participation, thereby improving learning outcomes abilities (Oknaryana et al., 2025).

Criterion 7 obtained a mean rating of 3.33, which is still interpreted as "Excellent", indicating that the Panag-on Eco Book includes necessary safety and cautionary notes in relevant topics and activities. This suggests that the materials demonstrate awareness of potential risks associated with learning tasks, particularly lower mean compared to other criteria implies that there is still room for improvement in strengthening and making these precautionary statements more explicit and comprehensive.

With an overall mean score of 27.3 out of 28, these results indicate that the Panag-on Eco Book is a well-developed instructional material that is both learner-centered and pedagogically appropriate. Its alignment with the curriculum ensures that the targeted learning competencies are effectively addressed, while the integration of inquiry-based and contextualized activities facilitates deeper conceptual understanding and active learner engagement.

Table 3. Evaluation result of the Panag-on Ecobook as to Format

Factor 2: Format	**Mean**	**Description**
1. Print		Excellent
1.1 Size of letters is appropriate to the intended user.	4	Excellent
1.2 Spaces between letters and words facilitate reading.	4	Excellent
1.3 Font is easy to read.	4	Excellent
1.4 Printing is of good quality (i.e., no broken letters, even density, correct alignment, properly placed screen registration).	4	Excellent
2. Illustration		
2.1 Simple and easily recognizable.	4	Excellent
2.2 Clarify and supplement the text.	4	Excellent
2.3 Properly labelled or captioned (if applicable).	4	Excellent
2.4 Realistic / appropriate colors.	4	Excellent
2.5 Attractive and appealing.	4	Excellent
2.6 Culturally relevant.	4	Excellent
3. Design and Layout	4	
3.1 Attractive and pleasing to look at.	4	Excellent
3.2 Simple (i.e., does not distract the attention of the reader).	4	Excellent
3.3 Adequate illustration in relation to text.	4	Excellent
3.4 Harmonious blending of elements (e.g., illustrations and text).	4	Excellent
4. Paper and Binding	4	
4.1 Paper used contributes to easy reading.	4	Excellent
4.2 Durable binding to withstand frequent use.	3.33	Excellent
5. Size and Weight Resources	4	
5.1 Easy to handle.	3.67	Excellent
5.2 Relatively light.	4	Excellent

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Total	**71**	**Passed**

Table 3 presents the evaluation result of the Panag-on Eco Book in terms of format, with an overall mean score of 71, interpreted as "Passed". This indicates that the material meets the required standards for quality instructional resources.

In terms of Print, all indicators obtained a mean of 4, showing that the font size, spacing, readability, and print quality are appropriate and facilitate ease of reading. A study by Day et al. (2024) emphasizes that readability features such as font and spacing significantly influence comprehension and learner engagement.

For the Illustration, the material consistently earned a mean score of 4. This indicates that the visuals are simple, recognizable and culturally relevant, effectively serving to clarify and supplement the text. According to Alali and Al-Barakat (2025), well designed educational illustrations act as "indispensable cognitive tools" that provide comprehensible input, making abstract scientific concepts more concrete. The mean score of 4 affirms that the Eco Book successfully uses imagery to bridge the gap between complex information and student understanding.

The category of Design and Layout similarly achieved a mean score of 4, that signifies a blending of elements that are attractive without being distractive. This shows that the material adheres to the principle of Mayer's Multimedia Learning Theory, which suggests that students learn more effectively when related words and pictures are physically integrated. As noted by Nacionales (2025), such well-organized instructional materials are essential for improving conceptual understanding and fostering deeper engagement with scientific topics.

Regarding Paper and Binding, the Eco Book has a mean score of 4 for paper quality and 3.33 for the durability of binding. While the paper contributes to ease of reading, the lower score for binding suggests that its physical resilience for frequent use may require reinforcement. A study by Palorma (2025), highlights that the effectiveness of instructional materials is often compromised by a lack of durable resources in high-use environments, noting that physical resilience is just as important as content accuracy for a quality learning experience.

Finally, the Size and Weight Resources category obtained a mean score of 4 for being relatively light and 3.67 for being easy to handle. These findings indicate that the Eco Book is ergonomically designed for its target demographic, facilitating portable and independent study. According to Cruz-Ocampo (2025), the physical accessibility and user-friendliness of localized materials are key factors in successful curriculum implementation, as learners are more likely to engage frequently with resources that are easy to handle.

With an overall score of 71 out of 72 points, Table 4 indicates that the material meets the Department of Education standards for quality instructional resources. All indicators under print, illustration, and design and layout received a mean of 4, reflecting excellent readability, visually supportive illustrations, and well-organized layout that enhance comprehension. Slightly lower ratings were noted in binding, durability with a mean score of 3.33 and ease of handling with a mean score of 3.67, suggesting a minor area for physical improvement. The overall mean score implies that the Eco Book is highly usable, learner-friendly, and visually effective, which supports cognitive processing and engagement. Studies affirm that well-designed instructional materials significantly improve learners understanding and motivation (Moreno and Mayer, 2021). Additionally, a study by Sari et al. (2022), shows that readability, visual integration, and ergonomic design contribute to deeper learning and sustained engagement in science education.

Table 4. Evaluation result of the Panag-on Ecobook as to Presentation and Organization

Factor 3: Presentation and Organization	**Mean**	**Description**
1. Presentation is engaging, interesting, and understandable.	4	Excellent
2. There is logical and smooth flow of ideas.	4	Excellent
3. Vocabulary level is adapted to target reader's likely experience and level of understanding.	4	Excellent
4. Length of sentences is suited to the comprehension level of the target reader.	4	Excellent
5. Sentences and paragraph structures are varied and interesting to the target reader.	4	Excellent
Total	**20**	**Passed**

Table 4 presents the evaluation of the Panag-on Eco Book in terms of presentation and organization, obtaining an overall mean score of 20, indicating that the material meets the required standards for instructional quality and clarity.

As seen in Table 5, all criteria received a mean rating of 4. First, the engaging and understandable presentation suggests that the Eco Book effectively captures learners' attention, which is essential in promoting motivation and comprehension. A study by Portana (2021), shows that well-presented instructional materials enhance engagement and facilitate meaningful learning. Additionally, the logical and smooth flow of ideas indicates coherence in content delivery, enabling learners to connect concepts progressively.

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Organized materials are proven to support better cognitive processing retention. Third, appropriate vocabulary level obtained a mean score of 4, this ensures that the content is suited to learners' comprehension, making complex scientific ideas more accessible. Fourth, the sentence length and suitability criteria obtained a mean of 4, which shows that the material supports readability, preventing cognitive overload. Lastly, for the varied and interesting sentence structure criteria which have a mean score of 4, it shows that the material enhances learner engagement and sustain attention throughout.

A study by Abad and Hattie (2025), highlights that well-designed instructional materials play a critical role in enhancing instructional design and improving learning outcomes by ensuring clarity, organization, and learner engagement. In the context of Panag-on Eco Book, the evaluation results in presentation and format which has an overall mean score of 20, reflect that the material effectively integrates these principles, making content more accessible and meaningful to learners. The development of the Eco Book demonstrates alignment with the current educational research, emphasizing the importance of well-organized, learner-centered materials in achieving science education.

Table 5. Evaluation result of the Panag-on Ecobook as to Accuracy and Up-to-datedness of Information

Factor 4: Accuracy and Up-to-datedness of Information	**Mean**	**Description**
1. Conceptual errors.	4	Excellent
2. Factual errors.	4	Excellent
3. Grammatical errors.	4	Excellent
4. Computational errors.	4	Excellent
5. Obsolete information.	4	Excellent
6. Typographical and other minor errors (e.g., inappropriate or unclear illustrations, missing labels, wrong captions, etc.).	4	Excellent
Total	**24**	**Passed**

Table 5 presents the evaluation of the Panag-on Eco Book in terms of accuracy and up-to-datedness of information, obtaining an overall mean score of 24, interpreted as "Passed", indicating that all criteria were rated 4. This signifies that the material is free from conceptual, factual, grammatical, and computational errors, and contains updated and reliable information, reflecting a very high level of quality and credibility. Each criterion received a mean score of 4 implies that the Eco Book maintains precision and correctness in all aspects. The overall mean score of 24 indicates a strong consistency and reliability of the material being assessed, suggesting that it fully meets established standards. Moreover, the absence of obsolete and typographical errors further strengthens its usability and trustworthiness as an instructional material.

The evaluation results shows that the Panag-on Eco Book displays accuracy, is well-organized, and aligned with instructional standards, which supports effective learning and comprehension (Smith, 2020). The presentation and structure of the material enhance clarity and engagement, as well-organized instructional resources are essential in improving knowledge acquisition and retention (Johnson and Lee, 2021). Moreover, embedding clear and properly structured content warrants that learners can easily process and understand complex concepts, highlighting the importance of organized instructional design (Brown et al., 2022).

Table 6. Summary of the Experts' Evaluation Result

Factors	**Total Mean**	**Description**
1. Content	27.3	Passed
2. Format	71	Passed
3. Presentation and Organization	20	Passed
4. Accuracy and up-to-datedness of Information	24	Passed
Remarks	**Recommended for Approval**	

Table 6 summarizes the overall evaluation of the experts on the Panag-on Eco Book. The table shows that content obtained a mean score of 27.3, format with 71 points, presentation and organization with 20 out of 20 points, and accuracy and up-to-datedness with 24 points. These shows that the Panag-on Eco Book satisfies the key quality standards for instructional materials, particularly in terms of relevance, structure, and correctness.

The content mean score of 27.3 reflects alignment with curriculum needs and learning competencies, which is essential in ensuring that the instructional materials address identifies learning gaps, as curriculum-based resources significantly improve student achievement and learning relevance (Garcia and Bautista, 200). The format mean score of 71 out of 72 points signifies that the Eco Book meets the print resource standards such as readability, layout, and visual clarity, which are crucial for learner engagement and comprehension (Santos et al., 2021). According to LRMDS print resource evaluation guidelines, materials must demonstrate educational soundness, appropriate design, and usability to be considered high quality. Furthermore, the presentation and organization score of 20 points indicates logical sequencing and coherence of ideas, supporting

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effective knowledge delivery, while the accuracy score of 24 points confirms that the material is free form conceptual and factual errors, ensuring credibility and CVR of information (Torres et al., 2024).

Passing all criteria is important because the LRMDS framework requires instructional material to meet standards in intellectual property, educational soundness, and technical quality before it can be recommended for use or distribution. These findings support that the Panag-on Eco Book was reviewed and validated appropriately, which is essential in producing effective educational resources.

IV. DISCUSSION

In light of the newly implemented Strengthened Senior High School General Science curriculum, a need for instructional materials that are aligned with the updated competencies and responsive to students' learning arise. To address this, the development of localized and contextualized learning material is essential. The initial phase identified learning gaps through a diagnostic assessment. The scores revealed that while students possessed a foundational awareness of climate change, they significantly struggled with its specific impacts on Philippine biodiversity. These identified deficiencies provided the empirical baseline for the selection of topics and objectives featured in the developed material.

The study adopted the ADDE model, as the framework for creating the instructional material. This systematic approach provided a structured pathway to ensure the instructional material was pedagogically sound and well-aligned with the newly implemented competencies. By following this model, the researcher was able to transition from identifying learner needs to designing a localized framework that integrated local contexts. This framework ensured that every component of the material, from objectives to activities, was grounded in established instructional design principles.

The development phase transformed the design framework into the Panag-on Eco Book, featuring localized sections title Tinutuyo, Hunahuna-a, Buluhaton, Pagtakus, and Tinubdan. By integrating local environmental contexts specific to Negros Occidental, abstract scientific theories more relatable and meaningful for the learners. The material was structured to follow simple to complex progression, incorporating inquiry-based tasks that encouraged learners to connect science to real-world situations. This process resulted in a cohesive and culturally relevant learning tool that addressed the identified gaps in climate change and biodiversity education.

Expert Evaluation using the DepEd Learning Resource Evaluation Tool confirmed the quality of the Panag-on Eco Book. The material achieved "Passed" status across all four evaluation factors including content, format, presentation and organization, and accuracy and up-to-datedness of information. These scores indicate that the instructional material met the rigorous standards for print resources, with evaluators specifically highlighting its effectiveness in fostering higher-order thinking skills. Ultimately, Panag-on Eco Book received the final remark of "Recommended for Approval", deeming it a superior and acceptable tool for classroom implementation.

The study addressed identified learning gaps in climate change and biodiversity through the development of Panag-on Eco Book. Integration of local environmental contexts and indigenous knowledge changes the material's abstract scientific concept into a contextualized lesson that bridge theoretical knowledge to real-world applications.

V. CONCLUSION

In line with the implementation of the Strengthened Senior High School Curriculum there was a need for a localized and contextualized instructional material that will support science education among learners. Needs analysis through a 50-item multiple-choice researcher-made diagnostic test was administered to 50 Grade 11 learners revealed that while learners have a foundational understanding of climate change, they struggle significantly with higher-order competencies, specifically in explaining how climate change impacts Philippine biodiversity. The data collected provided the baseline evidence needed to support and guide the structured content of the Panag-on Eci Book.

To systematically address these gaps, the study utilized the ADDE model. This model is divided into four stages: analysis, design, development, and evaluation. This guided the instructional material that transformed the identified learning needs to instructional objective. This framework also ensured the material evolved through continuous evidence-based feedback. Supporting this, the integration of Taba's Grassroot Approach ensured that the curriculum development was inductive, rooted in the actual classroom realities and specific conceptual difficulties of the Grade 11 learners.

The study resulted in the development of the Panag-on Eco Book, a curriculum-aligned and context-specific instructional resource. The material enhances conceptual understanding by translating abstract ecological concepts into relatable experiences through localized sections. By grounding content in the Negros Occidental ecosystem, the Eco Book bridges the gap between scientific theory and the learners' local environment.

Finally, the Evaluation phase validated the quality and instructional efficacy of the material. The "Excellent" ratings across content, format, and organization indicate that the Eco Book met the Department of Education's LRMDS standards. Consequently, the Panag-on Eco Book stands as an academically thorough and validated material capable of enhancing the conceptual understanding and environmental literacy of learners in the context of climate change and biodiversity.

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REFERENCES

[1]. Abbass, Kashif & Qasim, Muhammad & Song, Huaming & Murshed, Muntasir & Mahmood, Haider & Younis, Ijaz. (2022). A review of the global climate change impacts, adaptation, and sustainable mitigation measures. Environmental Science and Pollution Research. 29. 42539-42559. 10.1007/s11356-022-19718-6.

[2]. Agduma, A. R., Dela Cruz, K. C., Tanalgo, K. C., Lidasan, A. K., Edradan, J., Dumayas, R. K. L., Alagdon, J. S., Villaruz, B. D., & Gatoc, G. K. P. (2023). Drivers of extinction risks and shortfalls across terrestrial vertebrates in the Philippine global biodiversity hotspot. Science of The Total Environment, 873, 162235. https://doi.org/10.1016/j.scitotenv.2025.180274.

[3]. Alali, M., & Al-Barakat, A. (2025). The role of educational illustrations as cognitive tools in scientific conceptualization. Journal of Science Education Research, 12(1), 45–60.

[4]. Alejandro, I. R. (2025). Enhancing professional education: Effectiveness of instructional materials in Philippine higher education. Journal of Interdisciplinary Perspectives, 3(10), 101–105, 10.69569/jip.2025.572.

[5]. Andersson, M., Boateng, K., & Abos, P. (2024). Validity and reliability: The extent to which your research findings are accurate and consistent. ResearchGate. https://www.researchgate.net/publication/384402476.

[6]. Andriani, R., Safriana, S., Winata, I. W., & Ameliah, I. (2024). The understanding of higher-order thinking skills (HOTS) among middle school science teachers in Lhokseumawe, Indonesia. International Conference Proceedings, 17(4), DOI:10.29103/micoms.v4i.898

[7]. Balbin, S. A., Quendangan, M. M., & Garcia, R. E. (2025). The development and evaluation of a digital review material utilizing mobile application. Scientific and Engineering Journal (SciEnggJ), 18(Supplement), 202–218. https://scienggj.org/2025-special-issue-18/

[8]. Banzuelo, R. S., & Quiñones, M. T. (2026). Challenges in the localization of science instructional materials in the Philippine senior high school curriculum. Journal of Educational Innovation and Development, 14(2), 112–125, http://dx.doi.org/10.11594/ijmaber.07.01.08.

[9]. Bell, T., Urhahne, D., Schanze, S., & Ploetzner, R. (2019). Collaborative inquiry learning: Models, tools, and challenges. International Journal of Science Education, 32(3), 349–377.

[10]. Bello, J. B., Concon, L. S., Polache, M. C. C., Ayaton, M. J. C., Manlicayan, R. D., Campomanes, J. P., & Saro, J. M. (2023). Contextualized and localized science teaching and learning materials and its characteristics to improve students' learning performance. ResearchGate, 10.5281/zenodo.7607686.

[11]. Bello, J. P., Olayinka, A. R., & Olatoye, R. A. (2023). Impact of localized and contextualized instructional materials on student academic performance in science. International Journal of Educational Research and Reviews, 11(4), 215

[12]. Branch, R. M. (2009). Instructional design: The ADDIE approach. Springer. (pp. 16-17)

[13]. Bercasio, R. R. O., Maldo, M. P., & Maldo, G. H. P. (2021). Integrating environmental education in the English education curriculum. BU R&D Journal, 24(3), 1–11, 10.47789/burdj.mbtcbbgs.20212403.1

[14]. Buendia, J. M. P., Arciaga, M. R., Cortez, J. B., & Dela Cruz, J. M. M. (2025). Inquiry-based learning in science education. Pantao: International Journal of the Humanities and Social Sciences, 4(2), 1256–1261. (p. 1)

[15]. Bulleri, F., Bruno, J. F., Silliman, B. R., & Stachowicz, J. J. (2018). Facilitation and the organization of plant and animal communities. The Journal of Ecology, 106(2), 382–395.

[16]. Camuyong, S. C. (2023). Integrating value formation in localized science instructional materials: A holistic approach. Philippine Journal of Science Education, 9(1), 56–70.

[17]. Chapman, K. (2021). Characteristics of systematic reviews in the social sciences. The Journal of Academic Librarianship, 47(5), Article 102396, https://doi.org/10.1016/j.acalib.2021.102396.

[18]. Cruz-Ocampo, M. L. (2025). Barriers to effective climate change education in public secondary schools. Environmental Education Review, 18(3), 201–218.

[19]. Dorji, T. (2025). Understanding how indigenous knowledge contributes to climate change adaptation and resilience: A systematic literature review. Environmental Management, 76(1), https://doi.org/10.1007/s00267-024-02032-x.

[20]. Dumale, C. P., & Gurat, M. G. (2023). Grade 12 students' retention in statistics and probability amidst Covid-19. American Journal of Educational Research, 11(8), 534–541, DOI:10.12691/education-11-10-6.

[21]. Duran, M., & Dokme, I. (2016). The effect of the inquiry-based learning approach on student's critical thinking skills. Eurasia Journal of Mathematics, Science and Technology Education, 12(12), 2887–2908.

[22]. Fourqurean, J. W., Johnson, M. S., & Duarte, C. M. (2023). Climate change impacts on coastal ecosystems: Mangroves and coral reefs. Global Change Biology, 29(5), 1420–1435.

[23]. Furtak, E. M., Seidel, T., Iverson, H., & Briggs, D. C. (2019). Experimental and quasi-experimental studies of inquiry-based science teaching: A meta-analysis. Review of Educational Research, 82(3), 300–329.

[24]. Genizera, J. B., Tosino, W., Santacera, E. M., & Moncera, A. M. (2022). Implementation of Department of Education Programs, Projects, and Activities on Mitigating the Impact of Climate Change in the Philippines. Journal of Learning and Development Studies, 2(1), 35-39. https://doi.org/10.32996/jlds.2022.2.1.4

[25]. Gilead, T. (2026). Resilience and adaptive capacity: Rethinking educational structures in the age of climate crisis. Environmental Education Research. https://doi.org/10.1080/13504622.2026.2636179

[26]. Hajati, K., & Amaliah, N. (2022). Developing instructional materials through the ADDIE model. Journal of Education and Learning, 16(2), 145–152. (pp. 16-17)

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may619

[27]. Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2017). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). Educational Psychologist, 42(2), 99–107.
[28]. Huang, Q., Muhamad, M. M., & Che Nawi, N. R. (2025). Impact of instructional design on students' critical thinking and engagement in online English reading classes: Mediating role of motivation and moderating role of language proficiency. Frontiers in Psychology, 16, (p. 1), 10.3389/fpsyg.2025.1644126.
[29]. Jaya, S., Zaharudin, R., Hashim, S. N. A., Ithnin, M. A., Zaid, S. M., Mapjabil, J., & Nordin, M. N. (2021). Employing design and development research (DDR) approach in designing next generation learning spaces (NGLS) in teachers' pedagogy and technology tools. Review of International Geographical Education Online, 11(7), 1237–1246. https://rigeo.org/menu-script/index.php/rigeo/article/view/1831
[30]. Joshi, B., & Raval, N. (2026). Instructional design models – A review. European Economic Letters, 16(1), 1078–1085 (p. 1).
[31]. Kang, H., Windschitl, M., Stroupe, D., & Thompson, J. (2017). Designing, supporting, and monitoring learning opportunities for early-career teachers. Journal of Teacher Education, 68(3), 282–295.
[32]. Lacanilao, G. D., & Manalastas, R. P. (2023). Alignment of instructional materials with K-12 science competencies: An evaluative study. Journal of Curriculum and Instruction, 15(1), 88–104.
[33]. Lazonder, A. W., & Harmsen, R. (2016). Meta-analysis of inquiry-based learning: Effects of guidance. Review of Educational Research, 86(3), 681–718.
[34]. Macalikod, R., & Simpal, E. A. (2025). Development and validation of Science Instructional Materials (SIMs) for the least learned competencies. Journal of Social, Humanity, and Education, 5(3), 195–209. https://doi.org/10.35912/jshe.v5i3.2735
[35]. Macasinag, M. L. M. (2021). Assessment of environmental education materials for professional education courses in the teacher education curriculum. BU R&D Journal, 24(3), 77–90. 0.47789/burdj.mbtcbbgs.20212403.7
[36]. Mallillin, L. L. D., Mallillin, J. B., Ampongan, Y. D., Lipayon, I. C., Mejica, M. M., & Burabo, J. Z. (2023). Instructional design for effective classroom pedagogy of teaching. Eureka: Journal of Educational Research, 1(2), 41–52 (p. 1), https://doi.org/10.56773/ejer.v1i2.6
[37]. Mediana Jr., B., Funa, A. A., & Dio, R. V. (2025). Developing inquiry-based and localized instructional materials in science education. Asia Pacific Journal of Educational Research, 8(1), 45–58. (pp. 6, 36)
[38]. Nacionales Jr., N. P. (2025). Design, development, and validation of a strategic intervention material in chemical reaction. Journal of Interdisciplinary Perspectives, 2(12), 520-528.
[39]. Nelson, B. (2025). Iterative instructional design: A dynamic process of feedback and evaluation. eLearning Doc. https://elearningdoc.com/iterative-instructional-design-process/
[40]. Oknaryana, O., Putri, D. H., & Ahda, Y. (2025). Effectiveness of context-based instructional materials in improving student engagement. Journal of Biological Education, 10(1), 32–47.
[41]. Oktaviani, A., & Masjud, Y. I. (2024). Nature based solution to climate change: Ecosystem based adaptation: How effective for climate change strategies? Journal of Earth Kingdom, 1(2), 81–90. https://doi.org/10.61511/jek.v1i2.2024.576
[42]. Olumorin, C. O., Yusuf, M. O., Ajidagba, U. A., & Jekayinfa, A. A. (2022). Development of instructional materials using the ADDE model. Journal of Instructional Technology, 15(3), 201–215. (pp. 4, 8, 16)
[43]. Ong, K. C. A., & Bonganciso, R. T. (2024). Pedagogical well-being of teachers in different modalities: Input to HyFlex pedagogical wellness model. Ho Chi Minh City Open University Journal of Science-Social Sciences, 15(2), 76–93. https://doi.org/10.46223/HCMCOUJS.soci.en.15.2.3022.2025
[44]. Organisation for Economic Co-operation and Development. (2025). Trends shaping education 2025. OECD Publishing. https://www.oecd.org/en/publications/trends-shaping-education-2025_ee6587fd-en.html
[45]. Osher, D., Cantor, P., Berg, J., Steyer, L., & Rose, T. (2020). Drivers of human development: How relationships and context shape learning and development. Applied Developmental Science, 24(1), 6–36.
[46]. Palorma, L. B. (2025). Assessing the durability and usability of printed learning resources in public high schools. Journal of Educational Technology and Systems, 22(4), 310–325.
[47]. Pan, T., et al. (2023). Climate education for sustainable futures: A cross-country study of India and the Philippines. Education International. https://www.ei-ie.org/en/item/31738:climate-education-for-sustainable-futures-a-cross-country-study-of-india-and-philippines
[48]. Pitchay, L. M., & Torrentira, M. C. (2022). Governance challenges and knowledge management gaps in Philippine biodiversity conservation. Philippine Journal of Public Administration, 66(1), 45–62.
[49]. Portana, A. M. (2021). Visual presentation and organization of instructional materials: Enhancing learner comprehension. Philippine Journal of Basic Education, 5(2), 15–29.
[50]. Rahmah, S., & Risnani, L. (2023). Enhancing student engagement and comprehension through contextualized science materials. Journal of Science Education and Technology, 32(4), 580–595.
[51]. Richey, R. C., & Klein, J. D. (2019). Design and development research: Methods, strategies, and issues. Routledge.
[52]. Safitri, W. D., Halim, A., & Ibrahim. (2025). The impact of culturally responsive materials on student motivation and language learning outcomes. Curricula: Journal of Curriculum Development, 4(2), 1107-1122. https://doi.org/10.17509/curricula.v4i2.86915

ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may619

[53]. Salacayan, M. H., Malayao, S., Jr., Nabua, E., & Adamat, L. (2024). Utilization of develop contextualized learning module on climate change for Grade 9 learners. International Journal of Research and Innovation in Social Science, 8(4), 1398–1405, https://dx.doi.org/10.47772/IJRISS.2024.804104.
[54]. Sales, G. C., Ramos, J. L., & Santos, D. M. (2022). Integration of Philippine biodiversity concepts in the senior high school curriculum. Journal of Environmental Science and Management, 25(2), 89–104.
[55]. Samilo, K. J. (2025). Evaluation of the strengthened senior high school science curriculum: A transition study. Educational Reform Journal, 12(1), 77–92.
[56]. Samilo, P. J. E. (2025). Creating and evaluating instructional materials to foster purposeful communication in Filipino language learning. Journal of Qualitative Research in Education, (45), 78–89. https://doi.org/10.54963/jqre.i45.1904
[57]. Sari, P. K., Ramli, M., & Rinanto, Y. (2022). Readability and visual integration of biology textbooks: Impact on student learning outcomes. Journal of Physics: Conference Series, 1842(1), 012025.
[58]. Senadheera, V. V., Ediriweera, D. S., & Rupasinghe, T. P. (2024). Instructional design models for digital learning in higher education — A scoping review. Journal of Learning for Development, 11(1), 15–26. https://doi.org/10.56059/jl4d.v11i1.973
[59]. Suharyati, H., et al. (2024). Applying constructivist learning theory to enhance student learning outcomes in elementary schools. International Journal of Sustainable Development & Future Society, 2(2), 62–69, 10.62157/ijsdfs.v2i2.73.
[60]. Sulatra, I. K. (2022). Designing higher-order thinking skills (HOTS) based instructional materials in science. Journal of Education and Learning, 16(3), 334–342.
[61]. Sumardi, Wahyudiati, D., & Rispawati. (2025). The effect of culturally-integrated TEE model teaching materials on students' critical thinking and cultural literacy. Frontiers in Education, 10, 1-15, doi: 10.3389/feduc.2025.1720212.
[62]. Taba, H. (1962). Curriculum development: Theory and practice. New York: Harcourt, Brace & World.
[63]. Tatari, F., Ebrahimi, M., & Tadayon, H. (2025). Design, implementation, and evaluation of faculty member evaluation process using electronic 360-degree method. BMC Medical Education, 25(941), 1–12, https://doi.org/10.1186/s12909-025-07384-4.
[64]. Tlili, A., Zhao, J., Yang, K., Wang, Y., Bozkurt, A., Huang, R., & Ashraf, M. A. (2024). Going beyond books to using e-books in education: a systematic literature review of empirical studies. Interactive Learning Environments, 32(5), 2207–2231. https://doi.org/10.1080/10494820.2022.2141786
[65]. Trust, T., & Whalen, J. (2020). Should teachers be trained in instructional design? Journal of Technology and Teacher Education, 28(2), 189–199. (p. 10)