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Innovative contextualized instructional materials utilizing ethanolic crude extract from blue porter weed (Stachytarpheta Jamaicensis) for enhancing science learning in the Philippines

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Abstract: Plant extracts are valuable natural resources with diverse applications in pharmaceutical and food industries that can enhance science educa-tion by connecting theoretical knowledge to real-world applications, fostering critical thinking, and promoting environmental awareness. The study aimed to design and evaluate contextualized instructional materials for Grade 7 Science, focusing on integrating Blue Porterweed (Stachytarpheta jamaicensis), a locally abundant medicinal plant, into the curriculum to address the limitations of traditional rote learning methods. The research utilized the ADDIE model, which guided the process through its phases: Analysis, Design, Development, Implementa-tion, and Evaluation. Expert evaluators, science teachers, and Grade 7 students participated in the study to ensure the materials' effectiveness and relevance. Data was collected using the standard Learning Resource Management and Development System (LRMDS) Evaluation Rating Sheet and researcher-developed questionnaires, validated using Lawshe's Content Validity Ratio to ensure validity, and employed the In-ter-class Correlation Coefficient (ICC) to assess reliability. The findings revealed that the developed instructional materials—which included a module, lesson plan, learner activity sheets, and a teacher's guide—met high-quality standards. Additionally, these materials significantly enhanced student engagement and motivation. The study concluded that contextualized instruction positively impacts science education out-comes. The study recommends the broader adoption of such instructional materials in educational settings and suggests further research to explore their long-term effects and potential applications in other subject areas.

Keywords: *Contextualized Instructional Materials, Junior High School students, Philippines, Science Education, Stachytarpheta jamaicensis.*

1. Introduction

Science education equips learners with the knowledge and skills to comprehend the natural world and make informed decisions [1,2]. However, traditional science teaching methods often rely on rote memorization, hindering student engagement and understanding [3-7]. To address this, contextualized instruction has emerged as a promising approach [8-11] to enhance student motivation, achievement, and scientific thinking [8,12].

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Contextualized instruction integrates science with students' lives [8,9]; likewise, it enhances learning by making it relevant and engaging [13]. By connecting science to real-world applications, such as plant medicine [14], students can develop critical thinking and problem-solving skills [15].

The Department of Education (DepEd) in the Philippines emphasizes contextualization in Science Education through DepEd Order No. 34, s. 2017, encouraging the development of culturally relevant and locally aligned instructional materials [16]. One underutilized plant resource with the potential for contextualized Science instruction is Blue Porterweed (Stachytarpheta jamaicensis).

Blue Porterweed, locally known as "sentimiento," is a widely distributed Philippine plant species whose distribution extends across tropical and subtropical parts of Asia with documented medicinal properties [17,18]. The plant is easy to cultivate and its widespread availability make it a promising resource for developing contextualized Science instructional materials [19]. While Blue Porterweed is acknowledged for its potential in educational learning, research and development work should be undertaken for the development and introduction of new products into the community [18], but limited use of natural products in teaching and learning is limited in the Philippine science education [20]. A primary reason for this underutilization is the scarcity of instructional materials centered on this plant. To fully harness Porterweed as both a tangible material for scientific inquiry and a thematic focus for learning, developing and implementing contextualized teaching resources are essential. This approach aligns with established principles of effective learning [21,22].

This study aimed to develop and evaluate the effectiveness of contextualized instructional materials featuring Blue Porterweed ethanolic extract for Science7 students in the Philippines. The study investigated the impact of these materials on students' understanding of scientific concepts, their ability to apply scientific knowledge to real-world contexts, and their overall engagement in science learning. The contextualized learning materials aimed to bridge the gap between science education and real-world applications by incorporating local plants into the Grade 7 Science curriculum; enhance students' understanding of scientific concepts, including quantitative concentrations and ecological features. It could benefit students, teachers, curriculum developers, science educators, local communities, researchers, and future researchers. Students will develop practical skills in preparing solutions and measuring concentrations, while teachers may have a ready-to-use tool for engaging teaching concentration competency. Curriculum developers may use the findings to create more effective and locally relevant curricula, while science educators may use the findings to inform professional development programs and workshops. The study may also contribute to the broader knowledge base on contextualized instruction and inform future research on related topics.

1.1. Statement of the Problem

The study aimed to develop and evaluate the contextualized instructional materials featuring Blue Porterweed (Stachytarpheta jamaicensis) in Science 7 curriculum in the Philipppines.

Specifically, this study aimed to answer the following questions:

1. What are the least mastered competencies in Science 7 in quarter one (1) of the school year 2023–2024?
2. What model could be used to design the contextualized instructional materials featuring Blue Porterweed (Stachytarpheta jamaicensis) based on the least mastered competencies in the Science 7 lesson?
3. What instructional materials could be developed to effectively incorporate the use of Blue Porterweed (Stachytarpheta jamaicensis) based on the least mastered competencies in the Science 7 lesson, and how do experts validate these materials in terms of format, content, presentation, organization, accuracy, and up-to-datedness of information?
4. How would the developed contextualized instructional materials be implemented in the Science 7 curriculum?

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5. What are the teachers' and students' evaluations of the contextualized learning materials in terms of content, structure and coherence, learning activities, usefulness, general appearance and organization, and contextualization?

1.2. Theoretical Framework

This study was grounded in several theoretical and conceptual frameworks. Primarily, this study was informed by the principles of constructivism by Jean Piaget. Constructivism posits that learners actively construct knowledge through interactions with their environment [23,24]. Contextualized instructional materials align with this by providing meaningful and relevant learning experiences [25]. Integrating Blue Porterweed into the Science 7 curriculum offers hands-on experiences to facilitate student engagement and understanding. By anchoring the study in constructivism, it ensures that the developed instructional materials promote active learning and knowledge construction.

Likely, this study pulled upon the principles of Inquiry-based learning by John Dewey. Inquiry-based learning emphasizes curiosity, exploration, and investigation [26]. Featuring Blue Porterweed encourages students to ask questions, conduct experiments, and make observations about the plant. Adopting inquiry-based learning fosters critical thinking, problem-solving, and a deeper understanding of scientific inquiry.

Furthermore, this study was underpinned by the framework of ecological literacy as conceptualized by David Orr [27]. Orr posits that ecological literacy emphasizes the intricate relationship between humans and the natural world [28,29]. By integrating the study of Blue Porterweed, students were afforded opportunities to delve into the complexities of biodiversity, ecosystem dynamics, and conservation practices. Grounded in ecological literacy, this research aimed to cultivate environmental consciousness and foster a sense of responsibility towards the planet.

The frameworks of constructivism, inquiry-based learning, ecological literacy, and curriculum development theories were effectively integrated into the MATATAG Science Curriculum. Constructivism served as the foundational framework, emphasizing active knowledge construction through hands-on experiences with Blue Porterweed. Inquiry-based learning complemented this by fostering curiosity and investigation, aligned with the plant's potential for experimentation. Ecological literacy provided a broader perspective, promoting environmental awareness and understanding of interconnectedness. The ADDIE model acted as a procedural guide, ensuring systematic development and evaluation of instructional materials. By combining these theories, the curriculum aimed to create engaging, effective, and ecologically conscious learning experiences for seventh-grade students.

The research was informed by the principles of curriculum development and instructional design. The instructional materials featuring Blue Porterweed are designed following the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) to ensure systematic planning, development, and evaluation of the curriculum [30,31]. By following this model, the research aims to create effective contextualized instructional materials that are aligned with learning competencies, engage students in meaningful learning experiences, and promote scientific understanding and ecological literacy.

1.3. Conceptual Framework

As shown in Figure 1, through Analyze, Design, Develop, Implement, and Evaluate phases of the ADDIE model [32-34], the diagram draws a systematic process for developing contextualized instructional materials featuring the Blue Porterweed (Stachytarpheta jamaicensis) within the scope of science, for seventh-grade students. Starting with an input phase that involves analysis to understand the educational needs and curriculum requirements. The process then continues through various phases: design, development, implementation, and evaluation, wherein each step is carefully crafted to ensure the instructional materials are pedagogically sound and aligned with educational objectives. The output is a set of contextualized instructional materials in which Blue Porterweed will be integrated into the

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science curriculum, enhancing student learning experiences and fostering a deeper understanding of science concepts through real-world context.
The conceptual framework of this study was made clear by the following schematic diagram.

Figure 1.
Schematic diagram showing the ADDIE model in the context of the study.

2. Methodology

2.1. Research Design

This study employed a developmental research design in tandem with the ADDIE instructional design model. Developmental research is suitable for crafting, refining, and evaluating instructional materials [35]. The ADDIE model, comprising analysis, design, development, implementation, and evaluation phases, provided a structured approach to creating contextualized materials. This research design allowed for iterative improvement of the materials based on formative and summative assessment data. The developmental research design was chosen to ensure the alignment of instructional materials with learners' needs and the real-world context. By integrating the ADDIE model, the study systematically addressed each phase of material development, from needs assessment to evaluation, enhancing the validity and reliability of the research findings [36,37].

2.2. Participants of the Study

The study involved a total of 101 participants across various phases and roles. As the DepEd, Philippines stipulated that each resource should be evaluated independently by at least 2 evaluators, the study employed four expert evaluators, selected according to the Learning Resource Management Development System (LRMDS) guidelines. It provided critical assessments of the instructional materials. This group comprised a science teacher, a master teacher in science, and a school head [38].

Additionally, one Grade 7 Science teacher and thirty-four Grade 7 students from the public secondary school participated in both the study's pilot testing and implementation phases and evaluated the materials from a pedagogical standpoint. Their involvement was crucial for evaluating the practical application and effectiveness of the materials in a real classroom setting.

Furthermore, ten Science teachers from public secondary schools evaluated the materials from a pedagogical standpoint (including a pilot tester). Thirty students and fifteen teachers were engaged in reliability testing to ensure the reliability of the evaluation instruments. Finally, eight teachers served as validators to confirm that the materials met educational standards and effectively supported the intended learning outcomes.

The total number of participants was 101, consisting of 4 expert evaluators, 34 students, 10 Science teachers, 30 students, and 15 teachers for reliability testing, and 8 validators of the researcher-made questionnaire.

2.3. Research Instruments

This study employed two primary instruments to assess the quality and efficacy of the developed contextualized instructional materials: 1.) Evaluation Rating Sheet for PRINT Resources of LRMDS;

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2.) Teacher's Evaluation of Contextualized Learning Materials in Science 7; and Student's Evaluation of Contextualized Learning Materials in Science 7.

The first instrument was the Evaluation Rating Sheet for PRINT Resources of LRMDS, a standardized rubric provided by the Department of Education (DepEd, 2009). This rubric served as a comprehensive guide for evaluating the suitability of print materials for use in public schools, focusing on four (4) aspects such as format, content, presentation and organization, and accuracy and up-to-date information. The resource must score at least 21 points out of a maximum of 28 points to pass this criterion for content. Additionally, he must obtain a score of at least 54 points out of a maximum of 72 points to pass this criterion for format. He must also obtain at least 15 points out of a maximum of 20 points to pass this criterion for the Presentation and Organization. The resource must also obtain a score of 24 out of 24 points to pass this criterion for Accuracy and Up-to-date Information. It has a descriptive rating and a score based on four criteria: 4 being Very Satisfactory (VS); 3 - Satisfactory (S); 2 - Poor; and 1 – Not Satisfactory. For a rating below 4, comments/justifications are given on each evaluation criterion. If an evaluation criterion is Not Applicable (NA), the material is rated 3 on said criterion.

The Teacher's Evaluation and the Student's Evaluation of Contextual Learning materials for science 7 were the two researcher-made instruments employed in this study. Both instruments underwent rigorous teacher and student validation using Lawshe's Content Validity Ratio (CVR) to ensure they accurately measure their intended constructs [39]. The CVR analysis identified essential items for assessing material quality and capturing student perceptions.

Likewise, the inter-rater reliability was assessed through the Inter-class Correlation Coefficient (ICC), demonstrating substantial agreement among raters for both instruments [40], confirming their reliability. These instruments were developed to evaluate teachers' and students' perceptions of the materials' content, structure, coherence, learning activities, usefulness, appearance, organization, and contextualization. Both researcher-made instruments have a descriptive rating and a score based on four criteria: Outstanding (O), which means developed learning material conforms with the parameter; Very Satisfactory (VS), which entails that developed learning material substantially conforms with the parameter; Satisfactory (S) that entails the developed learning material barely conforms with the parameter; and Unsatisfactory (U) means that the developed learning material does not conform with the parameter.

The following scale was utilized to interpret the teacher's and students' evaluation of the contextualized learning materials:

Mean score range	Interpretation	Descriptive Interpretation
3.51 – 4.00	Outstanding	Developed learning material conforms with the parameter.
2.51 – 3.50	Very Satisfactory	Developed learning material substantially conforms with the parameter.
1.51 – 2.50	Satisfactory	Developed learning material barely conforms with the parameter.
1.0 – 1.50	Unsatisfactory	Developed learning material does not conform with the parameter.

The reliability of the Teacher's Evaluation of Contextualized Learning Materials in Science 7 was rigorously assessed to ensure its effectiveness as a tool for evaluating contextualized instructional materials. The instrument, created specifically for this study, underwent validation using Lawshe's Content Validity Ratio (CVR) to confirm that it accurately measured the constructs it was designed to assess. This process occurred during the initial phase of the study, involving a panel of 8 experts who reviewed the instrument's items to determine their relevance and necessity. The CVR analysis resulted

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in a Content Validity Index (CVI) of 0.983, which exceeded the critical value of 0.75, thereby validating the instrument's content [39].

The instrument's consistency was evaluated using inter-rater reliability, measured through the average Inter-class Correlation Coefficient (ICC). This assessment, conducted during the data collection phase, yielded an ICC of .750, indicating substantial agreement among raters and confirming the instrument's reliability [40]. The Teacher's Evaluation instrument was structured into several key sections: content, structure and coherence, learning activities, usefulness, appearance, organization, and contextualization, with each section containing a specified number of items to ensure a comprehensive evaluation. This meticulous approach ensured that the instrument provided reliable and consistent feedback on the effectiveness of the contextualized instructional materials.

The reliability of the Student's Evaluation of Contextualized Learning Materials in Science 7 was meticulously evaluated to ensure it provided accurate and consistent feedback. This researcher-made instrument, used to gather student perspectives on the instructional materials, underwent rigorous validation using Lawshe's Content Validity Ratio (CVR) to confirm its effectiveness in capturing relevant student feedback. The validation process occurred during the initial phases of the study and involved a panel of 8 experts who assessed the instrument's items for their relevance and necessity. The CVR analysis resulted in a Content Validity Index (CVI) of 0.975, surpassing the critical value of 0.75, thus validating the instrument's content.

The average Inter-class Correlation Coefficient (ICC) was employed to assess reliability, reflecting the consistency of the instrument's ratings across different raters. This assessment was conducted during the data collection phase and resulted in an ICC of .765, indicating substantial agreement among raters and confirming the instrument's reliability. The Student's Evaluation instrument was organized into several key sections: content, structure and coherence, learning activities, usefulness, appearance, organization, and contextualization. Each section included specific items designed to capture detailed student feedback, ensuring that the instrument effectively reflected students' experiences and preferences regarding the instructional materials.

2.4. Data Collection Procedures

The data collection procedures for the study on developing and evaluating contextualized instructional materials featuring Blue Porterweed (Stachytarpheta jamaicensis) for Grade 7 Science were conducted systematically according to the phases of the ADDIE model. The steps taken in each phase were as follows:

2.4.1. Phase 1: Analysis

The participants in this phase were Grade 7 junior high school students from an Annex School. Their age, educational background, learning styles, and needs in science were considered to ensure that the materials would be relevant and effective.

A thorough needs assessment was performed by analyzing the list of least-learned competencies for Grade 7 Science students prepared by the Science 7 teacher. This assessment aimed to determine the knowledge, skills, and attitudes students needed to acquire, highlighting performance gaps or areas requiring improvement. The list of least-learned competencies shows that out of five (5) competencies, learning competency number 5, which "Express concentrations of solutions quantitatively by preparing different concentrations of mixtures according to uses and availability of materials" was the least known competency among participants. This competency poses the most significant challenge, with most students struggling to apply the concepts of concentration and proportions to prepare solutions with specific concentrations. They also face difficulties in relating these concepts to real-world applications.

The learners' environment, culture, and real-world experiences were examined to select content that would be relevant and authentic. This analysis helped in understanding how to effectively integrate the Blue Porterweed into the instructional materials as it is readily available in the locale of this study.

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Clear and measurable learning objectives were defined based on the needs assessment. The list of least-learned competency number 5, which "Express concentrations of solutions quantitatively by preparing different concentrations of mixtures according to uses and availability of materials" [41], was what learners should be able to achieve after engaging with the contextualized instructional materials.

2.4.2. Phase 2: Design

Instructional strategies were designed to align with the learning objectives and the learners' characteristics. The strategy incorporated real-world scenarios related to Blue Porterweed and problem-solving tasks to make the learning experience more engaging and applicable.

Contextualized instructional materials were created to be relevant and engaging, reflecting the cultural and linguistic backgrounds of the learners. These materials included a module, lesson plans, student activity sheets, and a teacher's activity guide.

Formative and summative assessments were designed to measure learner progress and achievement. The assessments included authentic tasks that simulated real-world challenges related to the study of Blue Porterweed.

A storyboard outlining the sequence of instructional activities and materials was created. This plan visualized how the materials would be presented and how students would interact with them.

2.4.3. Phase 3: Development

The contextualized instructional materials were developed, including a module, lesson plans, student activity sheets, and a teacher's activity guide. Efforts were made to ensure these materials were visually appealing, easy to understand, and accessible to all learners.

Real-world examples, case studies, and simulations related to Blue Porterweed were integrated into the materials. Authentic language and visuals resonated with the learners' experiences and made the content more relatable.

Science teachers, master teachers, and school heads evaluated the materials using the Evaluation Rating Sheet from LRMDS.

A small-scale pilot test was conducted with a selected group of Grade 7 students to identify issues and gather feedback on the materials' effectiveness and relevance. This feedback was used to make necessary refinements to the materials.

2.4.4. Phase 4: Implementation

The developed instructional materials were used to teach the target learners. Necessary support and guidance were provided throughout the learning process to ensure effective use of the materials. This phase was conducted during the National Learning Camp with permission from the school head and District Supervisor. The camp served as a practical testing ground for the instructional materials, simulating various educational and logistical conditions that might be encountered in regular school settings. This real-world testing provided valuable insights into the materials' performance and effectiveness across different scenarios.

A supportive learning environment was created to encourage active participation and collaboration. Various teaching strategies were employed to cater to learning styles and enhance engagement with the materials.

2.4.5. Phase 5: Evaluation

A comprehensive assessment of the contextualized instructional materials' quality and impact using the following methods was employed:

2.5. Teacher's Evaluation

Ten (10) Science teachers evaluated the contextualized instructional materials using the researcher-made evaluation instrument. The material was assessed using different parameters, including content,

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structure and coherence, learning activities, usefulness, general appearance and organization, and contextualization. The instrument was subjected to a validity test using Lawshe's Content Validity Ratio (CVR) with a critical value of 0.75 for eight panelists. The CVI value for the instrument is 0.983 (higher than the critical value of 0.75), which implies that the instrument is valid. The instrument underwent a reliability test using inter-rater reliability. An average Inter-class Correlation Coefficient (ICC) of .750 indicated substantial agreement among raters, confirming the instrument's reliability.

2.6. Student's Evaluation

Students evaluated the contextualized instructional materials using the researcher-made evaluation instrument. The material was evaluated in terms of content, structure and coherence, learning activities, usefulness, general appearance and organization, and contextualization. The instrument was subjected to validity testing using Lawshe's Content Validity Ratio (CVR) with a critical value of 0.75 for eight panelists. The CVI value for the instrument is 0.975 (higher than the critical value of 0.75), which implies that the instrument is valid. The instrument underwent a reliability test using inter-rater reliability. An average Inter-class Correlation Coefficient (ICC) of .765 indicated substantial agreement among raters, confirming the instrument's reliability.

Based on the evaluation findings, revisions were made to the instructional materials. Feedback from learners and teachers was incorporated to enhance the quality and effectiveness of the materials.

2.7. Data Analysis

The analysis of the Science 7 curriculum for the first quarter of the school year 2023–2024 was identified through a needs assessment involving performance data enclosed in the list of least-mastered competencies from their science teacher. This gap was addressed using the ADDIE instructional design model, which guided the creation of contextualized materials featuring Blue Porterweed (Stachytarpheta jamaicensis) by aligning instructional strategies with real-world scenarios. During the development phase, various instructional materials such as modules, lesson plans, student activity sheets, and a teacher's activity guide were evaluated by experts using the Evaluation Rating Sheet from the Learning Resource Management Development System (LRMDS), with statistical analysis validating the format, content, and accuracy through mean scores. Implementation of these materials during the National Learning Camp was monitored through observations and feedback, providing real-world testing data that confirmed their effective use and engagement. Finally, comprehensive evaluations by teachers and students used researcher-made instruments to assess various aspects such as content, structure, and usefulness, with statistical tools including Content Validity Ratios (CVR) for validity testing, Inter-class Correlation Coefficients (ICC) for reliability testing, and mean for determining the results of the evaluation by teachers and students on contextualized instructional materials.

2.8. Ethical Considerations

Ethical considerations included safeguarding participants' rights and well-being, informed consent, privacy, and social value. The study demonstrated its potential to improve the quality of science education by addressing the least mastered competencies in Science 7 and using locally available resources such as Blue Porterweed.

Informed consent was obtained from all participants, including students, teachers, and expert evaluators. The study minimized risks by involving experienced teachers and adhering to established research protocols. The potential benefits include improved student learning outcomes, enhanced teacher professional development, and the creation of valuable instructional materials for the wider educational community.

Participant data was treated with strict confidentiality, and written consent was obtained from participants. Transparency was maintained through explicitly outlined research objectives, rigorous validation of research instruments, and detailed documentation of data analysis procedures. The

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researcher's qualifications in educational research and instructional design ensured the competence and credibility of the research.

The study aimed to distribute benefits fairly among participants, with the potential benefits expected to be shared by the entire school community. The study was conducted within existing school facilities, providing adequate data collection and analysis resources. Future studies could consider involving community members in developing or evaluating instructional materials to enhance community engagement and increase the study's impact and relevance.

3. Results

3.1. On Analysis of the Least Mastered Competencies in Science 7

The first objective of this study was an in-depth analysis of the least mastered competencies in Science 7. Identifying these competencies served as the foundation for developing contextualized instructional materials (CIMs) aligned with the student's specific learning needs.

Identifying least mastered competencies (LMCs) in Science 7 is a crucial step in improving student learning outcomes and ensuring effective instruction [42]. This process involves analyzing assessment data to pinpoint specific concepts or skills where students exhibit the lowest levels of proficiency [43]. By recognizing these LMCs, educators can tailor their instructional strategies to address individual needs and bridge the gaps in understanding [44]. Moreover, this approach allows for the early detection of misconceptions or difficulties, enabling teachers to provide timely interventions and prevent further academic struggles [42,45].

Analyzing data from formative and summative assessments, such as quizzes, unit tests, and performance tasks, can reveal patterns and trends in student learning [46]. Teachers can then utilize this information to design targeted interventions, differentiated instruction, and additional practice opportunities to support students in mastering the LMCs [47]. By focusing on these areas of weakness, educators can optimize their instructional efforts and ensure that all students have the necessary foundation for future academic success [48].

Identifying and remedying LMCs is a continuous process that requires collaboration between teachers, students, and stakeholders. By proactively addressing these challenges, schools can create a more equitable and supportive learning environment where all students can thrive.

Table 1.
Students' mastery level of the learning competencies in science 7.

Competency	Mastery rate (%)	Remarks
Describe the components of a scientific investigation.	77	Students generally understand the steps in scientific inquiry but may struggle with specific components like data analysis and conclusion formation.
Recognize that substances are classified into elements and compounds.	75	While students can identify elements and compounds, they may have difficulty explaining their differences deeper.
Distinguish mixtures from substances based on a set of properties.	75	Students can identify some properties that differentiate mixtures from substances but may struggle with applying this knowledge consistently.
Investigate the properties of unsaturated or saturated solutions.	68	Students have a basic understanding of solution properties but need more practice differentiating between unsaturated and saturated solutions.
Express concentrations of solutions quantitatively by preparing different	55	This competency poses the most significant challenge, with most students struggling to apply the concepts of concentration and proportions to prepare solutions

concentrations of mixtures according to the uses and availability of materials.		with specific concentrations. They also face difficulties in relating these concepts to real-world applications.

Note: Low Mastery Rate (0-49%) Moderate Mastery Rate (50-79%) High Mastery Rate (80-100%)

The learning competencies assessed in Table 1 align with the Matter chapter in science 7. This chapter focuses on the properties and classification of matter, including elements, compounds, and mixtures. Students demonstrated a strong understanding of basic concepts but struggled with applying knowledge to practical situations, particularly in solution preparation.

Analysis of submitted documents from science 7 teachers reveals a concerning trend in student performance. As Table 1 illustrates, the competency of expressing concentrations of solutions quantitatively has the lowest mastery rate, with only 55% of students demonstrating proficiency. This data gathered directly from educators in the field, confirms the difficulties students face in translating a theoretical understanding of concentrations and proportions into practical skills. The teacher's observations highlight a significant gap between conceptual knowledge and real-world application, emphasizing the need for instructional strategies that bridge this gap and provide students with the necessary tools to master this essential scientific competency.

This result aligns with previous research highlighting the challenges students face in understanding concentration. For instance, misconceptions about the relationship between solute, solvent, and solution concentration are prevalent among secondary school students [49,50]. Furthermore, students often struggle to apply their knowledge of concentration to real-world scenarios, such as preparing solutions for specific purposes [51].

The relatively low mastery rate for this competency underscores the need for targeted interventions that address the specific difficulties students face in understanding and applying the concepts of concentration. These interventions could involve utilizing more concrete examples, hands-on activities, and real-world applications to help students develop a deeper understanding of the topic. Additionally, providing explicit instruction on the mathematical relationships involved in calculating concentrations and proportions may be beneficial [51].

Therefore, this study's findings highlight the necessity of developing contextualized instructional materials that address these identified challenges, incorporating practical applications and hands-on experiences to enhance student understanding and mastery of solution concentration concepts.

3.2. On Instructional Design and Strategies for Contextualized Learning Materials

The Science 7 Contextualized Learning Module effectively leverages Blue Porterweed (Stachytarpheta jamaicensis) to teach students about quantitative solution concentrations [52]. Aligning with the ADDIE model (Bureau of Learning Resources, DepEd-BLR, 2017), it provides a clear framework for pre-assessment, content delivery; hands-on activities like Blue Porterweed extract preparation, and post-assessment. This student-centered approach integrates contextual learning, active exploration, diverse instruction, and inquiry, reflecting contemporary best practices [52].

The module delves into fundamental concepts like solution nature and concentration, exploring various units (% m/m, % v/v, ppm) and their applications in medicine, environmental Science, and the food industry (Joshi et al., 2013). This equips students with a solid foundation and demonstrates real-world relevance. Additionally, the module recognizes Blue Porterweed's documented anti-inflammatory, analgesic, and wound-healing properties [52] by providing a step-by-step guide for extracting its medicinal components using ethanol [53]. This experiential component reinforces theoretical knowledge, cultivates practical laboratory skills, and fosters an appreciation for traditional medicinal practices.

The module's strengths lie in its engaging content, clear procedural guidance, robust safety emphasis, diverse assessment strategies, and alignment with established learning competencies [54,55]. These features contribute to an effective and student-centered learning experience.

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The lesson plan, learner activity sheet, and teacher's activity guide all effectively integrate multiple instructional design models to facilitate student learning. They primarily align with the Constructivist framework [23,24], emphasizing hands-on activities like preparing solutions and encouraging active knowledge construction. Additionally, they incorporate elements of Experiential Learning Theory, prompting students to observe, reflect, and discuss their findings during experiments, fostering deeper understanding.

To further enhance these components, consider incorporating Problem-Based Learning (PBL) strategies. Present real-world challenges related to solution concentrations, such as determining disinfectant or fertilizer concentration. This allows students to develop critical thinking and problem-solving skills while applying their knowledge meaningfully. Technology integration can further enhance the learning experience. By combining these models and strategies, the lesson plan, learner activity sheet, and teacher's activity guide can be further optimized for deep learning and real-world knowledge transfer.

Overall, this Science 7 Contextualized Learning Module offers a well-designed and engaging approach to teaching solution concentrations. By incorporating the suggested enhancements, the lesson plan, learner activity sheet, and teacher's activity guide can be further optimized for an even more effective and student-centered learning experience.

3.3. On Development and Expert Validation of Contextualized Instructional Materials

This section detailed the process of developing and validating contextualized instructional materials (CIMs) designed to address the least mastered competencies in science 7.

In response to the identified difficulty in expressing concentrations of solutions quantitatively among Grade 7 students (as evidenced by data gathered from science 7 teacher), contextualized instructional materials were developed, leveraging the local abundance of Blue Porterweed *(Stachytarpheta jamaicensis)*.

This approach aligns with research advocating for the use of locally relevant resources to enhance student engagement and comprehension (Darling-Hammond et al., 2019). The Blue Porterweed, a common plant in the area, served as the basis for hands-on activities and real-world scenarios. Students were tasked with preparing infusions of varying concentrations using Blue Porterweed leaves, thereby connecting abstract concepts like solute, solvent, and concentration to a tangible, familiar context. Additionally, the cultural significance of Blue Porterweed in traditional medicine was explored, further deepening students' understanding of the relevance of concentration in practical applications [8,56]. This multi-faceted approach, integrating local flora and cultural knowledge, aimed to bridge the gap between theoretical knowledge and practical application, fostering a deeper understanding of the concept of concentration among students.

Contextualized instructional materials, designed to enhance student engagement and comprehension, included a module, learner activity sheets, a teacher activity guide, and a lesson plan. The module provided a structured framework for the topic, incorporating the local abundance of Blue Porterweed (Stachytarpheta jamaicensis) as a central theme.

Learner activity sheets guided students through hands-on activities involving the preparation of Blue Porterweed infusions with varying concentrations, thus connecting abstract concepts to tangible experiences [57].

The teacher activity guide offered detailed instructions and suggestions for facilitating these activities, ensuring that educators felt confident and prepared to implement the contextualized approach.

The lesson plan outlined the sequencing of activities, incorporating formative assessments to gauge student understanding and inform instructional decisions.

This comprehensive suite of materials not only capitalized on the local relevance of Blue Porterweed to enhance student interest but also provided educators with the necessary tools to effectively implement a contextualized approach to teaching the concept of concentration. The inclusion of a

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variety of resources, such as the module, activity sheets, guide, and lesson plan, ensured that both students and teachers were well-equipped to navigate the complexities of the topic and ultimately achieve a deeper understanding of the concept of concentration.

The development and utilization of contextualized instructional materials, such as modules, learner activity sheets, teacher activity guides, and lesson plans, emerged as a pivotal aspect of addressing the challenges in teaching the concept of concentration to Grade 7 students. This approach is supported by a wealth of research highlighting the benefits of contextualization in improving student engagement, comprehension, and knowledge transfer [58,59]. These materials, rooted in the local context and incorporating the abundance of Blue Porterweed (Stachytarpheta jamaicensis), fostered a deeper understanding of the concept by connecting it to familiar experiences and real-world applications.

To highlight, the module served as a comprehensive guide, outlining the topic's scope and sequence while emphasizing the relevance of Blue Porterweed. This aligned with findings that contextualized modules enhance student motivation and self-efficacy [58]. Learner activity sheets designed to be interactive and inquiry-based, provided opportunities for students to apply theoretical knowledge in practical scenarios, consistent with research demonstrating the effectiveness of hands-on activities in promoting conceptual understanding [8]. The teacher activity guide, with its detailed instructions and suggestions, empowered educators to confidently implement the contextualized approach, echoing studies that emphasize the importance of teacher support in maximizing the impact of contextualized materials [59]. The lesson plan, incorporating formative assessments and differentiated instruction [60], ensured that the learning experience was tailored to individual needs and progress, a practice advocated for by research on personalized learning [61,62].

The significance of contextualized instructional materials, particularly in the realm of Science Education, is underscored by a growing body of research. Numerous studies have highlighted the efficacy of these materials in fostering student engagement, comprehension, and knowledge transfer. For instance, students who engaged with contextualized science materials exhibited greater interest and motivation compared to those who used traditional, decontextualized materials [8]. This heightened engagement translated into improved academic performance and a deeper understanding of scientific concepts.

Similarly, in contextualized materials, incorporating local examples and real-world applications, facilitated students' ability to connect abstract concepts to their everyday experiences [63,64]. This connection, in turn, enhanced their ability to apply scientific knowledge in novel situations and problem-solving tasks. Furthermore, research [65], revealed that contextualized materials catered to diverse learning styles, accommodating visual, auditory, and kinesthetic learners alike. This inclusive approach ensured that all students had equal opportunities to access and benefit from the learning experience.

The use of local resources, such as the Blue Porterweed in this study, aligns with findings that incorporating culturally relevant elements in instructional materials enhanced student engagement and fostered a sense of ownership over the learning process [66]. Additionally, contextualized materials promote critical thinking and problem-solving skills, as students are encouraged to analyze and interpret information within a meaningful context [45].

The evidence from multiple studies supports the notion that contextualized instructional materials, including modules, learner activity sheets, teacher activity guides, and lesson plans, play a crucial role in enhancing Science education. These materials, by grounding abstract concepts in familiar contexts, cater to diverse learning styles and promote active engagement, contributing to a more comprehensive and meaningful learning experience for students.

The utilization of contextualized instructional materials is grounded in the understanding that learning is optimized when it is situated within a meaningful context [8]. By connecting scientific concepts to familiar surroundings and local resources, students are more likely to develop a deeper understanding and appreciation for the subject matter. Research has consistently shown that contextualized learning experiences can lead to improved student motivation, engagement, and knowledge retention [67]. The current study builds upon this existing body of research by examining

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the efficacy of contextualized materials focused on Blue Porterweed, a plant with potential medicinal properties found in the local environment.

This part focuses on the expert validation of contextualized instructional materials in a Grade 7 Science setting. The materials were meticulously designed to align with the curriculum while incorporating local relevance and real-world applications. The evaluation by subject matter experts aimed to assess the content, format, presentation and organization, accuracy and up-to-datedness of information of these materials, providing crucial insights into their potential impact on student learning.

The assessment results for the contextualized Instructional Materials, as shown in Table 2, indicate an overall score, and a detailed breakdown of the scores for each criterion outlined in the LRMDS Assessment & Evaluation Guidelines is presented below:

Table 2.
Experts' validation of the contextualized instructional materials.

CIMs	Criteria	Mean score	Interpretation
Module			
	Content	26.0	Passed
	Format	68.0	Passed
	Presentation and organization	18.25	Passed
	Accuracy and Up-to-datedness of information	24.0	Passed
Learner activity sheet			
	Content	27.5	Passed
	Format	68.5	Passed
	Presentation and organization	19.0	Passed
	Accuracy and Up-to-datedness of information	24.0	Passed
Teacher activity guide			
	Content	28.0	Passed
	Format	69.25	Passed
	Presentation and organization	19.75	Passed
	Accuracy and Up-to-datedness of information	24.0	Passed
Lesson plan			
	Content	26.6	Passed
	Format	70.0	Passed
	Presentation and organization	19.5	Passed
	Accuracy and Up-to-datedness of information	24.0	Passed

Note: The resource must meet the following criteria to pass: Content: mean score ≥ 21.00; Format: mean score ≥ 54.00; Presentation and Organization: mean score ≥ 15.00; Accuracy and Up-to-datedness of Information: mean score = 24.00; N=4

As shown in Table 2, demonstrates that it meets the minimum requirements set forth in the LRMDS Assessment & Evaluation Guidelines. The individual scores for each criterion provide further insights into the module's strengths and areas for potential improvement.

The content mean score of 26 indicates that the module covers the required topics comprehensively and effectively. This result agrees with the importance of comprehensive content in promoting learner engagement and knowledge acquisition [68,69]. The mean score earned (26) exceeded the minimum requirement of 15, signifying that the module successfully passed this criterion.

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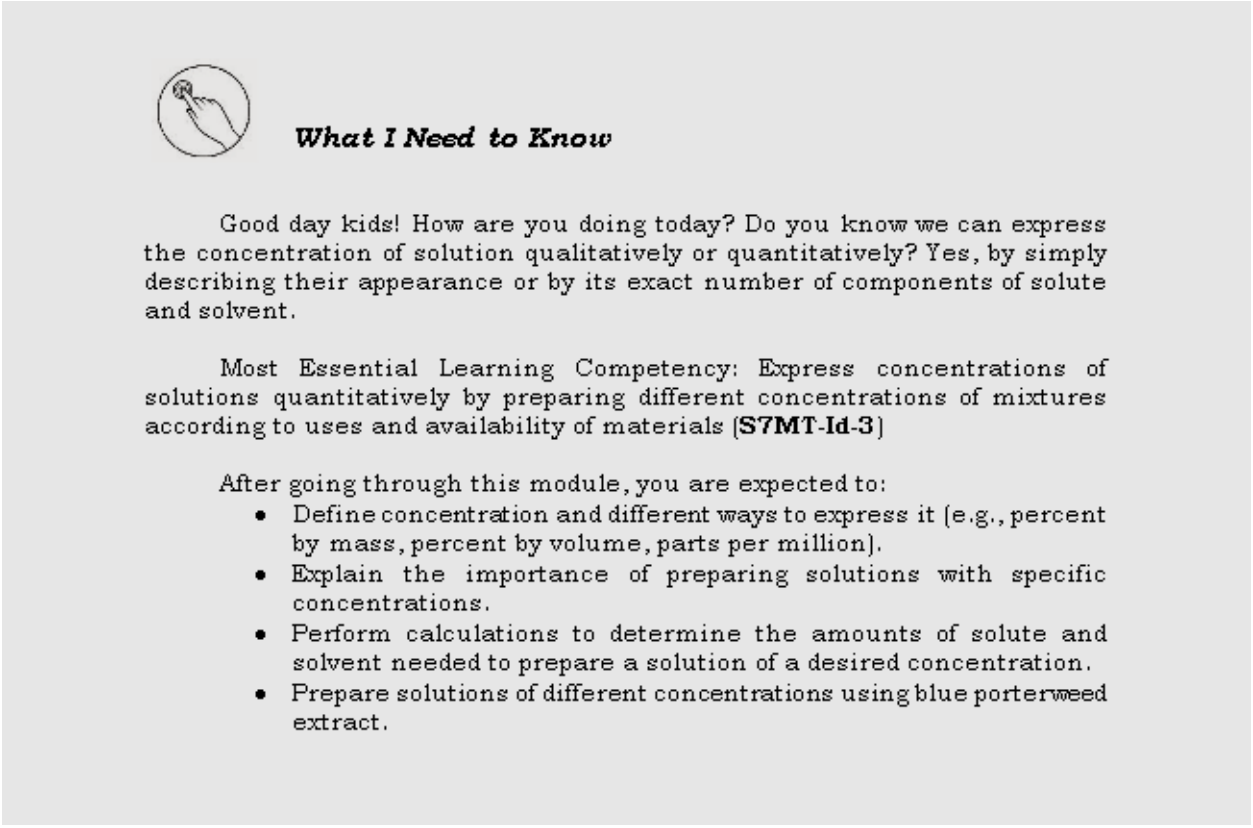
The high ratings for fostering critical thinking and problem-solving resonate with the growing emphasis on these skills in 21st-century education [70]. The module's success in avoiding bias and promoting values is also consistent with the call for inclusive and equitable educational materials [71].

The module introduced the concept of solution concentration, distinguishing between qualitative and quantitative expressions. It outlined the learning objectives, which included defining concentration, explaining its importance, performing concentration calculations, and preparing solutions using Blue Porterweed extract. The module achieved a passing score, indicating its alignment with LRMDS standards. Notably, the content demonstrated comprehensiveness, addressing key concepts effectively. It fostered critical thinking and problem-solving skills while maintaining an unbiased and inclusive approach, aligning with contemporary educational principles. (See Figure 2)



What I Need to Know

Good day kids! How are you doing today? Do you know we can express the concentration of solution qualitatively or quantitatively? Yes, by simply describing their appearance or by its exact number of components of solute and solvent.

Most Essential Learning Competency: Express concentrations of solutions quantitatively by preparing different concentrations of mixtures according to uses and availability of materials (**S7MT-Id-3**)

After going through this module, you are expected to:

- Define concentration and different ways to express it (e.g., percent by mass, percent by volume, parts per million).
- Explain the importance of preparing solutions with specific concentrations.
- Perform calculations to determine the amounts of solute and solvent needed to prepare a solution of a desired concentration.
- Prepare solutions of different concentrations using blue porterweed extract.

Figure 2.
Learning competency and learning objectives of the contextualized learning module in science 7

The format's mean score of 68 suggests that the module adheres to the prescribed formatting guidelines, ensuring readability and accessibility for learners. Research has shown that well-formatted materials enhance learner comprehension and overall satisfaction [72]. The module's strong adherence to established design principles aligns with research findings that emphasize the importance of format in enhancing the readability, comprehension, and overall appeal of learning materials [73,74]. The mean score in Figure 3 earned (68) exceeded the minimum requirement of 15, signifying that the module successfully passed this criterion.

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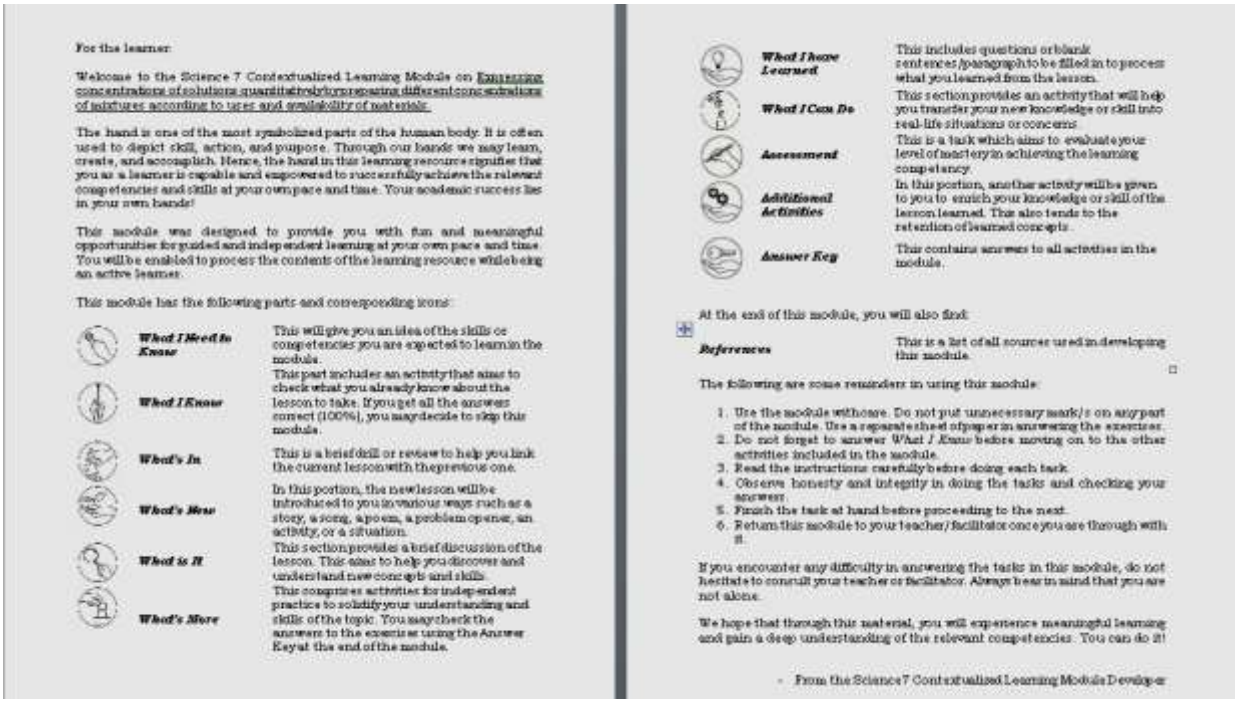

Figure 3.
Parts and corresponding icons of the contextualized learning module in science 7.

The positive validation of the module's format is consistent with studies highlighting the impact of well-structured and visually appealing materials on learners' engagement and performance [75,76]. The module's clear typography, appropriate spacing, and effective use of visuals align with research-based recommendations for designing instructional materials [77].

The module's high rating for criteria related to visual clarity and simplicity is also supported by studies that emphasize the importance of minimizing cognitive load and avoiding distractions in learning materials [78].

The mean score of 18.25 for presentation and organization indicates that the module is presented in a clear and logical manner, facilitating learner understanding. This supports with the findings that emphasized the importance of organized presentation in instructional materials [79]. The score earned (18.25) exceeded the minimum requirement of 15, signifying that the module successfully passed this criterion.

The results of the experts' validation align with the existing literature on effective instructional materials. Research emphasizes the importance of engaging and understandable presentations that cater to the target audience's comprehension level [80]. Additionally, the logical flow of ideas and varied sentence structures contribute to the coherence and readability of instructional materials, facilitating learning and retention. The module's success in these areas suggests that it adheres to established principles of effective instructional design.

The module's perfect score of 24 for accuracy and up-to-datedness of information reflects its adherence to current knowledge and best practices. This is crucial in ensuring the relevance and effectiveness of the module in meeting learner needs [81,82]. This implies that the experts found the module to be free of conceptual, factual, grammatical, and computational errors, and devoid of obsolete information.

The results strongly suggest that the module meets high standards for accuracy and currency of information. This conforms to the critical role of accurate and up-to-date content in instructional

materials. Furthermore, the absence of errors, both major and minor, suggests that the module has undergone rigorous quality control, adhering to best practices in instructional design.

The findings resonate with the broader educational literature emphasizing the importance of accuracy, currency, and clarity in instructional materials. The results of this expert validation suggest that the contextualized learning module aligns with these established principles, making it a promising tool for effective instruction.

The assessment results suggest that the module is a valuable resource that meets the established standards for quality and effectiveness. However, there is always room for improvement, and future iterations of the module could focus on enhancing the presentation and organization aspect to optimize the learning experience further.

The validation of the Learner Activity Sheet (LAS) yielded positive results across all assessment criteria which demonstrate a high degree of effectiveness. It notably surpassed the passing thresholds for content (27.5 out of 28), format (68.5 out of 72), presentation and organization (19 out of 20), and accuracy and up-to-datedness of information (24 out of 24).

This indicates a high level of satisfaction among the experts regarding the content of the activity sheet. The mean score of 27.25 out of a maximum of 28 points further confirms the positive validation. The finding that the content is suitable to the students' level of development aligns with research emphasizing the importance of aligning instructional materials with learners' cognitive abilities and prior knowledge. The material's contribution to achieving specific objectives reflects its alignment with curriculum standards and learning outcomes, a crucial aspect of effective instructional design [83].

The provision for developing higher cognitive skills, such as critical thinking, creativity, and problem-solving, is consistent with the growing emphasis on 21st-century skills in education; the absence of biases and prejudices reflects the importance of inclusivity and equity in educational materials [71].

The material's potential to arouse interest and the provision of adequate safety warnings demonstrate a consideration for learners' engagement and well-being, both of which are essential for effective learning [84].

The positive validation of the learner activity sheet is consistent with research highlighting the importance of high-quality instructional materials in promoting student learning and engagement [48,57]. The emphasis on higher cognitive skills, inclusivity, and student well-being aligns with contemporary educational trends and priorities.

The experts' validation of the learner activity sheet's format (68.5 out of 72) demonstrates a high degree of expert consensus on overall excellence. This high evaluation of the learner activity sheet reflects the importance of well-designed instructional materials in enhancing learning outcomes [74,76]. Specifically, the positive remarks on font size, spacing, printing quality, and ease of handling resonate with studies highlighting the impact of legibility and usability on learners' engagement and comprehension [78].

Furthermore, the experts' appreciation of the illustrations' relevance and overall aesthetic appeal aligns with the literature on the role of visuals in capturing attention, facilitating understanding, and improving the retention of information [85].

The expert validation provides strong evidence for the learner activity sheet's effectiveness in terms of format. It adheres to research-based instructional design principles, incorporating elements that promote a positive learning experience. While minor improvements in the aesthetic aspects could be considered, the overall quality of the format is deemed highly satisfactory and conducive to learner engagement.

This high level of satisfaction in terms of presentation and organization suggests that the presentation is engaging, the flow of ideas is logical, the vocabulary is appropriate for the target audience, and the sentence and paragraph structures are varied and interesting. The mean score of 19 points further confirms that the activity sheet has met the standards for effective presentation and organization, exceeding the minimum requirement of 15 points.

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These findings align with research emphasizing the importance of clear and engaging presentations in instructional materials. Mayer's (2014) cognitive theory of multimedia learning posits that learners are more likely to comprehend and retain information when it is presented in a well-organized and visually appealing manner. Additionally, studies have shown that using appropriate vocabulary and sentence structures can significantly enhance learner engagement and understanding [77]. The current findings echo these principles, demonstrating that the learner activity sheet's effectiveness can be attributed, in part, to its adherence to established principles of presentation and organization.

Table 2 also portrays the validation of the learner activity sheet by experts in terms of accuracy and up-to-datedness of information. The evaluation is based on six specific criteria: conceptual errors, factual errors, grammatical errors, computational errors, obsolete information, and typographical and other minor errors. This translates to a mean score of 24, indicating that the resource surpassed the passing threshold of 24 points.

The high score (24 out of 24) of the learner activity sheet is of exceptional quality in terms of accuracy and up-to-datedness. This implies that the content is free from conceptual misunderstandings, factual inaccuracies, grammatical mistakes, and computational errors. Additionally, the information presented is current and relevant, and the resource is well-presented with minimal typographical or other minor errors.

These findings align with the broader emphasis in educational research on the importance of providing students with accurate and up-to-date information (Kul et al., 2018; Ross & Morrison, 2020). The absence of errors in the learner activity sheet indicates that it has undergone rigorous review and editing, which is crucial for ensuring the reliability and validity of educational materials [86,87]. Moreover, the lack of obsolete information suggests that the resource has been recently updated, reflecting current knowledge and best practices in the field [88].

The Learner Activity Sheet (LAS) demonstrated exceptional quality across all evaluation criteria. Its content was comprehensive and aligned with learner needs, while its format and organization facilitated easy navigation and understanding. The LAS effectively conveyed information through clear and coherent presentation, and its accuracy and up-to-datedness ensured reliability as a learning resource in Figure 4.


Introductory Message

Welcome to Science Grade 7!

The **Learning Activity Sheet** is a product of the Research entitled "DEVELOPMENT AND EVALUATION OF CONTEXTUALIZED INSTRUCTIONAL MATERIALS USING BLUE PORTERWEED (*Stachytarpheta jamaicensis*) ETHANOLIC EXTRACT IN SCIENCE 7" conducted by the author. This resource is designed to support teachers, parents, and other learning facilitators in guiding students towards achieving the learning objectives outlined in the K to 12 Basic Education Curriculum.

The **Learning Activity Sheet** is designed to be a self-paced learning tool, empowering students to complete activities independently while utilizing resources available within their community. It aims to foster lifelong learning skills, knowledge, and attitudes that can lead to enhanced productivity and employment opportunities.

For learning facilitator:

The **Science Activity Sheet** is designed to guide you in facilitating the lessons and activities for each Most Essential Learning Competency (MELC), even with limited or no in-person interaction with the students. The sheet will be provided to learners along with resources and links to support their independent learning.

For the learner:

This **Science Activity Sheet** is designed to support your learning journey outside of the classroom. It offers engaging activities to help you learn independently. As an active learner, please carefully read and follow the instructions, complete the activities, and answer the assessments. This completed sheet should be returned to your instructor on the agreed-upon date.

Figure 4.
Developed learner activity sheet on concentrations of solutions featuring blue porterweed (Stachytarpheta jamaicensis).

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Table 2 also reveals a comprehensive evaluation of a Teacher Activity Guide, indicating a high overall quality. Notably, it exceeded the passing thresholds for all four criteria: Content (28/28), Format (69.25/72), Presentation and Organization (19.75/20), and Accuracy and Up-to-datedness of Information (24/24). The guide's particular strengths lie in its content accuracy and up-to-datedness, meeting all requirements in this category.

The experts' assessment indicates that the content of the teacher activity guide is developmentally appropriate, aligned with specific learning objectives, and promotes higher-order thinking skills. The material is also free of biases and prejudices, enhances desirable values and traits, and can potentially engage learners. Furthermore, including adequate safety and health precautions in relevant topics and activities underscores the guide's commitment to student well-being.

These findings are in congruent with the importance of high-quality instructional materials in supporting effective teaching and learning [89-92]. Specifically, studies have shown that materials that are engaging, relevant, and promote higher-order thinking skills are associated with improved student outcomes [93-95]. Furthermore, including safety and health precautions in instructional materials is considered a critical component of responsible teaching practice [96].

Finally, the experts' validation provides strong evidence that the teacher activity guide is a high-quality resource that can support effective teaching and learning. The guide's emphasis on developmentally appropriate content, higher-order thinking skills, and safety precautions align with current research and best practices in education.

The results of the experts' validation of the teacher activity guide in terms of its format (69.25 out of 72) indicate a high level of satisfaction among the experts. These results suggest that the guide's format excels in fundamental design aspects, ensuring a user-friendly and visually appealing experience.

These findings correspond with current research on effective instructional materials design. For instance, the Cognitive Theory of Multimedia Learning emphasizes the importance of clear, concise text, relevant visuals, and an organized structure to facilitate comprehension and retention [74]. Similarly, the principles of Universal Design for Learning (UDL) advocate for flexibility in representation, engagement, and expression to accommodate diverse learner needs [97]. The high ratings in Table 2 suggest that the teacher activity guide aligns with these principles, ensuring accessibility and usability for a wide range of users.

Furthermore, the emphasis on cultural relevance reflects the growing recognition of the importance of culturally responsive pedagogy. This approach is one that "uses the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them"[98]. The positive validation of the guide's cultural relevance suggests its potential to enhance engagement and learning outcomes for diverse learners.

Table 2 likewise reveals a comprehensive validation of the teacher activity guide's presentation and organization by experts in the field. This mean score 19.75 surpasses the minimum requirement of 15 points. A well-presented and organized guide can enhance user engagement, facilitate learning, and promote positive user experiences. The high ratings in all criteria suggest that the teacher activity guide excels in these aspects, making it a valuable resource for educators. Research consistently demonstrates that accurate, up-to-date, and well-designed resources can positively impact student learning outcomes [99-101]. The teacher activity guide's high evaluation in this study suggests that it has the potential to be an effective tool for educators.

The experts found the presentation to be engaging, interesting, and understandable, suggesting that the guide effectively captures and maintains the attention of its target audience [102]. The logical and smooth flow of ideas indicates a well-structured and coherent presentation, facilitating the comprehension of the content [103]. Adapting vocabulary level and sentence length to the target reader's experience and comprehension level demonstrates a user-centered design approach, ensuring accessibility and ease of use [104]. Moreover, the variety and interest in sentence and paragraph structures contribute to a dynamic and engaging reading experience [105].

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The experts found the teacher activity guide to be of high quality regarding accuracy and currency of information (69.25 out of 72). This is a significant finding as the accuracy and relevance of instructional materials are crucial factors in effective teaching and learning [8,90]. Inaccurate or outdated information can lead to misconceptions and hinder students' understanding of the subject matter [106,107].

The absence of conceptual, factual, grammatical, and computational errors indicates that the guide is meticulously prepared and free from inconsistencies or misleading content. This attention to detail is important as it reflects the credibility and reliability of the resource [107,108]. Additionally, the lack of obsolete information suggests that the guide is current and aligns with the latest developments in the field, which is crucial for ensuring the relevance of the teaching material [8]. Clear and visually appealing instructional materials can enhance students' engagement and comprehension [79].

Delving deeper into the results, the guide's mean score of 69.25 in Format suggests a well-structured and organized resource, though there might be minor areas for improvement to achieve the maximum score. The Presentation and Organization mean score of 19.75 further emphasizes the guide's user-friendliness and clarity. The mean score of 28 in Content signifies that the guide comprehensively covers the necessary topics and aligns with curriculum objectives. The Accuracy and Up-to-datedness of Information mean score of 24 highlights the guide's relevance and reliability as a teaching tool.

Given these findings, the Teacher Activity Guide is a valuable and dependable resource for educators. Its adherence to LRMDS criteria and high scores across all categories suggests it can significantly enhance teaching and learning experiences. The guide's strengths in content, accuracy, and organization make it an effective tool for delivering curriculum objectives. However, the slight margin for improvement in the Format category indicates a potential area for refinement in future iterations.

These results validate the importance of comprehensive evaluation frameworks like the LRMDS guidelines in ensuring the quality of educational resources [109]. The guide's strong performance in content and accuracy echoes research findings emphasizing the need for up-to-date and curriculum-aligned materials [110]. Furthermore, the guide's user-friendly presentation and organization reflect studies advocating for intuitive and accessible educational resources [74].

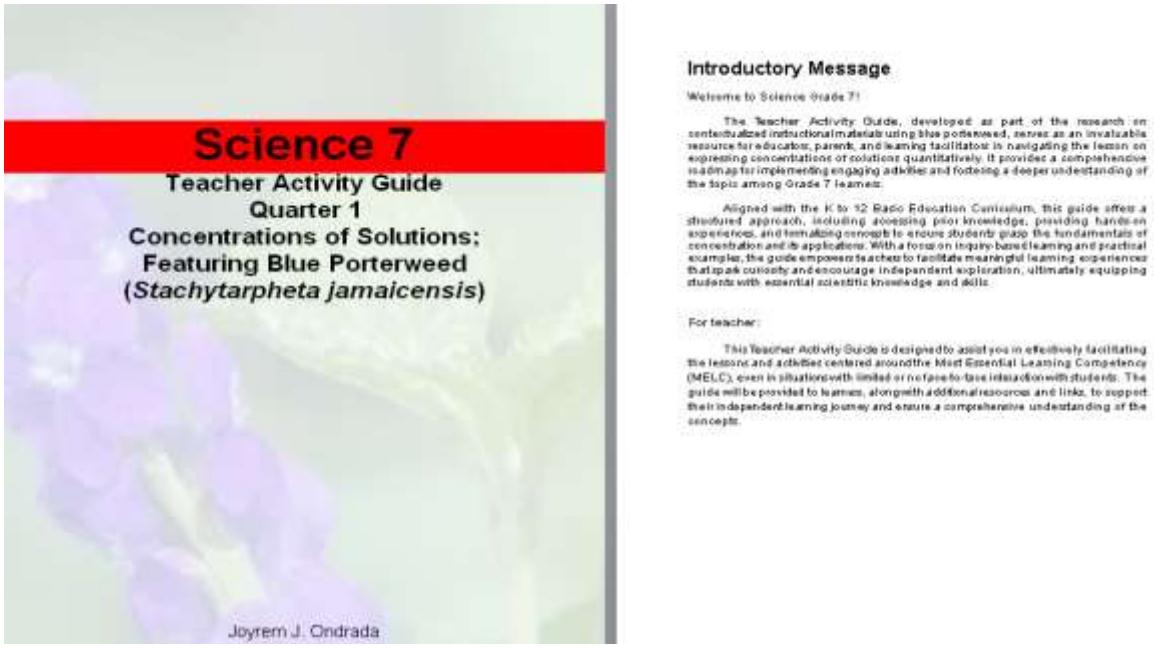

Figure 5.
Developed Teacher Activity Guide on Concentrations of Solutions Featuring Blue Porterweed (Stachytarpheta jamaicensis).

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The lesson plan's mean scores were attributed to its strong performance in several areas. Notably, the plan achieved a mean score in Accuracy and Up-to-datedness (24/24), aligning with the growing emphasis on current information in educational materials [111]. The high mean score (70/72) in Format suggests adherence to established guidelines, reflecting the importance of structure in facilitating student comprehension (Iqbal et al., 2021). While the content's mean score (26.6/28) met the passing threshold, it presents an area for potential improvement, as suggested by prior research emphasizing the critical role of content relevance in student engagement [69]. The plan also fared well in Presentation and Organization (19.5/20), indicating a clear and logical structure.

The high mean score (26.6/28) suggests that the lesson plan is well-designed in terms of content. The exceptional scores in areas like suitability to student development and contribution to objectives align with recent research emphasizing the importance of aligning content with learner needs and curriculum goals [112]. The high rating for promoting higher cognitive skills reflects the growing emphasis on critical thinking and problem-solving in education [113].

The mean score of 26, exceeding the minimum passing score of 21, demonstrates that the lesson plan's content meets expert expectations. This aligns with a study conducted highlighting the importance of expert evaluation in ensuring the quality and effectiveness of educational material [114].

The lesson plan's mean score of 70 surpassed the required threshold of 54, indicating that it successfully met the established criteria for a satisfactory format. It underscores the meticulous attention to detail invested in crafting the lesson plan's format. The result suggests that the lesson plan is not only visually appealing but also thoughtfully tailored to the needs and preferences of its intended audience [79].

Studies have consistently demonstrated that well-designed materials can improve learner engagement, comprehension, and retention. Additionally, research suggests that cultural relevance is pivotal in fostering a sense of connection and belonging among learners, particularly those from diverse backgrounds [115].

The mean score of 19.5 out of a maximum of 20 indicates that the lesson plan guide passed the evaluation with distinction concerning presentation and organization. The result indicates that the content will likely capture and maintain learners' attention and implies a coherent and easy-to-follow structure, facilitating understanding. It also suggests that the language used is appropriate for the target audience. This alignment between language and learner characteristics is crucial for effective communication and comprehension [77]. The lesson plan also avoids monotony and maintains learner interest through diverse sentence and paragraph structures. This variety aligns with research findings emphasizing the importance of varied stimuli in maintaining attention and enhancing learning [116].

Generally, the results suggest that the lesson plan guide is of high quality regarding presentation and organization. The findings are consonant with current literature emphasizing the importance of clear, engaging, and learner-centered instructional materials (Walters & Newman, 2008). The guide's strong performance across all criteria suggests its potential for effective implementation in educational settings.

Meanwhile, the mean score (24/24) focusing on the accuracy and up-to-datedness of the information suggests that the lesson plan is meticulously crafted and free from significant errors. The absence of conceptual, factual, and computational errors indicates the lesson plan's strong foundation in accurate and reliable information (Primiero, 2013). Furthermore, the lack of grammatical errors and typographical mistakes implies a high level of editorial care and attention to detail [117].

The absence of obsolete information is particularly noteworthy, as it demonstrates the lesson plan's relevance and currency in a rapidly evolving knowledge landscape [118]. This is crucial for ensuring that learners receive instruction that is both accurate and up-to-date.

The findings are compatible with the broader literature on instructional design, which emphasizes the importance of accuracy, currency, and clarity in educational materials [27]. Research has consistently shown that high-quality instructional materials, characterized by accurate and up-to-date information, positively impact student learning outcomes [74]. The absence of errors in the lesson plan,

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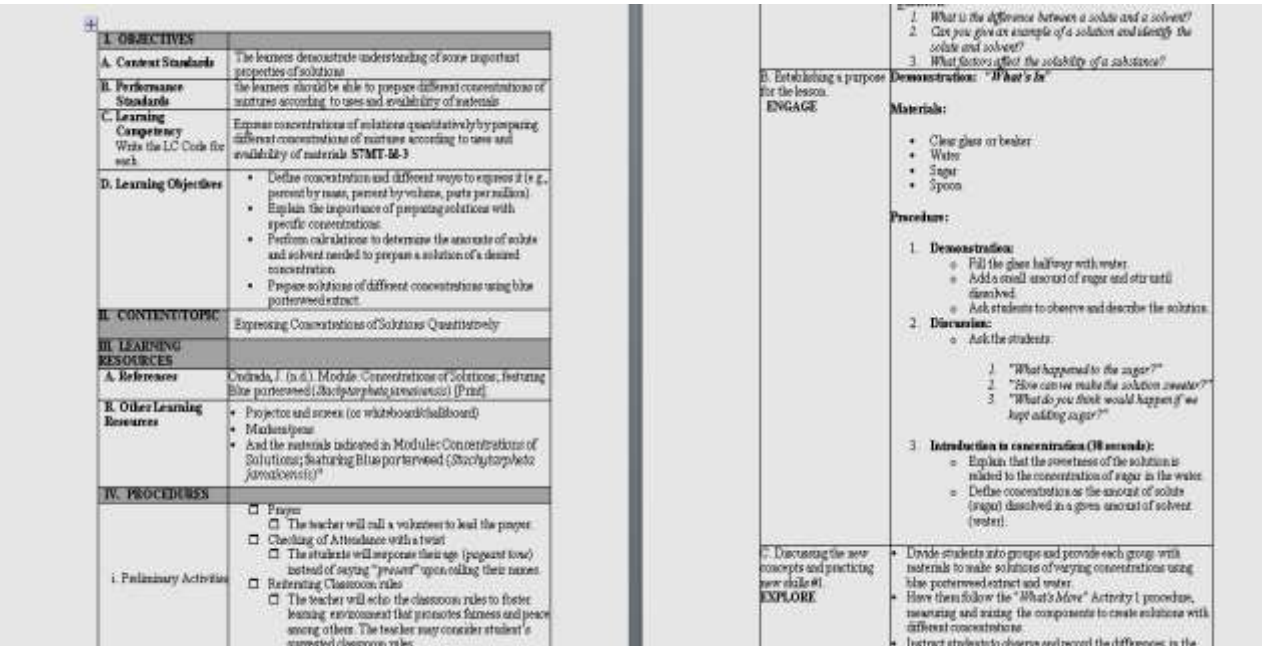
as evidenced by the expert evaluation, is consistent with best practices in instructional design, which prioritize error-free materials to avoid confusing or misleading learners [77].

The assessment results aligned with contemporary research trends. The emphasis on accuracy reflected the increasing importance of reliable information amidst rapidly evolving [119], while the focus on format adhered to established pedagogical principles for effective learning [120]. Moreover, the identified potential for content enhancement underscored the ongoing challenge of creating instructional materials that are both factually sound and engaging [69].



I. OBJECTIVES	
A. Content Standards	The learners demonstrate understanding of some important properties of solutions
B. Performance Standards	the learners should be able to prepare different concentrations of mixtures according to uses and availability of materials
C. Learning Competency Write the LC Code for each	Express concentrations of solutions quantitatively by preparing different concentrations of mixtures according to uses and availability of materials **S7MT-Ie-3**
D. Learning Objectives	• Define concentration and different ways to express it (e.g., percent by mass, percent by volume, parts per million) • Explain the importance of preparing solutions with specific concentrations • Perform calculations to determine the amounts of solute and solvent needed to prepare a solution of a desired concentration • Prepare solutions of different concentrations using blue portereweed extract
II. CONTENT/TOPIC	Expressing Concentrations of Solutions Quantitatively
III. LEARNING RESOURCES	
A. References	Ordinda, J. (n.d.). Module: Concentrations of Solutions; featuring Blue portereweed (*Stachytarpheta jamaicensis*) [Print]
B. Other Learning Resources	• Projector and screen (or whiteboard/chalkboard) • Markers/pens • And the materials indicated in Module: Concentrations of Solutions; featuring Blue portereweed (*Stachytarpheta jamaicensis*)"
IV. PROCEDURES	
i. Preliminary Activities	☐ Prayer ☐ The teacher will call a volunteer to lead the prayer ☐ Checking of Attendance with a twist ☐ The students will response their age (pagsuot tono) instead of saying "present" upon calling their names ☐ Reiterating Classroom rules ☐ The teacher will echo the classroom rules to foster learning environment that promotes fairness and peace among others. The teacher may consider student's suggested classroom rules

	1. *What is the difference between a solute and a solvent?* 2. *Can you give an example of a solution and identify the solute and solvent?* 3. *What factors affect the solubility of a substance?*
B. Establishing a purpose for the lesson **ENGAGE**	**Demonstration: "What's In"** **Materials:** • Clear glass or beaker • Water • Sugar • Spoon **Procedure:** 1. **Demonstration:** ◦ Fill the glass halfway with water. ◦ Add a small amount of sugar and stir until dissolved. ◦ Ask students to observe and describe the solution. 2. **Discussion:** ◦ Ask the students: 1. *"What happened to the sugar?"* 2. *"How can we make the solution sweeter?"* 3. *"What do you think would happen if we kept adding sugar?"* 3. **Introduction to concentration (30 seconds):** ◦ Explain that the sweetness of the solution is related to the concentration of sugar in the water. ◦ Define concentration as the amount of solute (sugar) dissolved in a given amount of solvent (water).
C. Discussing the new concepts and practicing new skills #1 **EXPLORE**	• Divide students into groups and provide each group with materials to make solutions of varying concentrations using blue portereweed extract and water. • Have them follow the "What's More" Activity 1 procedure, measuring and mixing the components to create solutions with different concentrations. • Instruct students to observe and record the differences in the

Figure 6.
Developed lesson plan on expressing concentrations of solutions quantitatively.

3.4. On Implementation of Developed Contextualized Instructional Materials

The implementation phase of the ADDIE model proved critical in translating the conceptualized instructional materials into tangible classroom experiences. This stage involved the strategic deployment of the developed modules, lesson plans, student activity sheets, and teacher's guide within the Science 7 curriculum. By adhering to the ADDIE framework, the researcher ensured a systematic and controlled introduction of the materials into the educational setting.

To gather empirical data on the materials' effectiveness, the researcher leveraged the National Learning Camp as a practical testing ground. This controlled environment enabled the observation of the materials in action, allowing for real-time adjustments and refinements. The camp setting provided a valuable opportunity to assess the materials' suitability for diverse learning contexts and to identify potential challenges or areas for improvement.

Through meticulous observation and feedback collection during the implementation process, the researchers gained insights into the materials' strengths and weaknesses. This iterative approach, grounded in the principles of the ADDIE model, facilitated the necessary modifications to enhance the materials' alignment with students' needs and learning outcomes. The implementation phase is crucial for validating the practical applicability of educational materials in real-world classroom settings.

The implementation phase was instrumental in bridging the gap between theory and practice. By systematically integrating the instructional materials into the classroom and gathering empirical data, the researchers refined the materials to meet the specific needs of science 7 students. The collaborative process involving teachers and students enhanced the materials' effectiveness and ensured their

alignment with curricular goals. These findings underscore the importance of a systematic and iterative approach to instructional design and development.

3.5. On Teachers and Students' Evaluation of Contextualized Instructional Materials

This section presents a comprehensive analysis of both teacher and student evaluations of the contextualized instructional materials (CIMs) employed in a Grade 7 Science course, specifically focusing on the Module and Learner Activity Sheet (LAS). Teachers' perspectives were crucial in assessing the CIMs' alignment with curriculum objectives, impact on student engagement, and adaptability to diverse learning contexts [47,63,98]. Concurrently, student evaluations provided invaluable insights into the materials' effectiveness and relevance from the learners' perspective, contributing to a holistic understanding of the CIMs' strengths and weaknesses.

A rigorous evaluation process was undertaken to assess the quality and effectiveness of the contextualized instructional materials (CIMs) and involved ten expert teachers. The CIMs, comprising a module, learner activity sheet, teacher activity guide, and lesson plan, were subjected to scrutiny across six key dimensions: content, structure, learning activities, usefulness, appearance, and contextualization. A four-point Likert scale (See Appendix B) was employed to quantify expert ratings, with scores ranging from 1.00 to 4.00 (Outstanding). This evaluation methodology aligns with established practices in instructional material assessment [8,121]. The quantitative data generated from this process, presented in Table 3, provide a foundational understanding of the materials' strengths and areas for potential enhancement.

Table 3.
Teachers' evaluation of the contextualized instructional materials.

CIMs	Criteria	Mean	Verbal interpretation
Module			
	Content	3.92	Outstanding
	Structure and coherence	3.8	Outstanding
	Learning activities	3.82	Outstanding
	Usefulness	3.88	Outstanding
	General appearance and organization	3.88	Outstanding
	Contextualization	3.84	Outstanding
Overall mean		3.86	Outstanding
Learner activity sheet			
	Content	3.78	Outstanding
	Structure and coherence	3.84	Outstanding
	Learning activities	3.84	Outstanding
	Usefulness	3.82	Outstanding
	General appearance and organization	3.8	Outstanding
	Contextualization	3.82	Outstanding
Overall mean		3.82	Outstanding
Teacher activity guide			
	Content	3.84	Outstanding
	Structure and coherence	3.8	Outstanding
	Learning activities	3.8	Outstanding
	Usefulness	3.86	Outstanding
	General appearance and organization	3.68	Outstanding
	Contextualization	3.84	Outstanding
Overall mean		3.80	Outstanding

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Lesson plan			
	Content	3.98	Outstanding
	Structure and coherence	3.96	Outstanding
	Learning activities	3.92	Outstanding
	Usefulness	3.92	Outstanding
	General appearance and organization	3.94	Outstanding
	Contextualization	3.94	Outstanding
Overall mean		3.94	Outstanding

Note: Interpretation is based on the following scale: 3.51 – 4.00 Outstanding, 2.51 – 3.50 Very Satisfactory, 1.51 – 2.50 Satisfactory, 1.0 – 1.50 Unsatisfactory; N=10.

The evaluation results reveal that the contextualized instructional module was rated in all criteria as content with a mean score of 3.92, structure and coherence of 3.80, learning activities of 3.82, usefulness of 3.88, general appearance and organization of 3.88, contextualization of 3.84, with the overall mean of 3.92. This indicates that the module met and exceeded the standards set by the evaluation tool. The high ratings across all criteria suggest that the module is a well-designed and effective instructional material.

The content rating with a mean score of 3.92, interpreted as Outstanding, aligns with previous studies emphasizing the significance of high-quality content in learning materials. It indicates that the module's content is comprehensive, accurate, relevant, and aligned with the intended learning outcomes.

The rating for structure and coherence, with a mean score of 3.80, interpreted as Outstanding, echoes findings from research on the importance of clear organization and logical flow in instructional materials (Mayer, 2009). This suggests that the module's content is well-organized and easy to follow, facilitating learners' understanding and retention.

The high rating for learning activities (mean = 3.82) is consistent with studies highlighting the effectiveness of active learning approaches [122]. The "Outstanding" rating suggests that the module's activities are engaging and interactive and promote active participation, contributing to a more effective learning experience.

The "Outstanding" rating for usefulness with a mean score of 3.88, reflects the module's relevance and applicability in real-world classroom settings. This finding aligns with research emphasizing the importance of practicality and relevance in instructional materials. It suggests that the module is a valuable resource that teachers can readily use to support their instruction.

The general appearance and organization have a rating of 3.88 as the mean score, interpreted as outstanding, indicates that the module is visually appealing and easy to navigate. A well-designed material can enhance learner engagement and motivation.

Finally, Contextualization has a mean score of 3.84, interpreted as Outstanding, reflecting the module's alignment with the principles of culturally responsive pedagogy [98]. This suggests that the module takes into account the diverse backgrounds and experiences of learners, making it more accessible and relevant to a wider range of students. This is supported as well that contextualized learning is crucial for enhancing student engagement and understanding [123].

Overall, the evaluation results provide strong evidence for the effectiveness of the contextualized instructional module as showed in the overall mean of 3.86 interpreted as "Outstanding". The high ratings across all criteria indicate that the module is a well-designed and valuable resource that can support teaching and learning in diverse educational settings.

For the evaluation of the learner activity sheet, the "Outstanding" ratings across all criteria underscore the LASs' high quality and alignment with established standards for instructional materials. This is consistent with previous research emphasizing the importance of these criteria in effective learning materials. The high score for Content, with a mean score of 3.78, indicates that the LASs are comprehensive, accurate, relevant, and aligned with curriculum objectives. This finding echoes studies

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emphasizing the importance of high-quality content in promoting student learning. The "Outstanding" rating for Structure and Coherence with a mean score of 3.84, reflects a logical flow, clear organization, and smooth transitions within the LASs. This aligns with research highlighting the importance of coherent structure in facilitating learners' understanding and engagement.

The high scores for Learning Activities with a mean score of 3.84, indicate the inclusion of diverse, engaging, and interactive activities that cater to various learning styles. The "Outstanding" rating for Usefulness obtained a mean score of 3.82, which signifies the LASs' perceived value and applicability in real-world classroom settings. This echoes research emphasizing the importance of practicality and relevance in instructional materials

The General Appearance and Organization obtained a mean score of 3.80, suggesting potential for minor enhancements further to optimize the visual appeal and layout of the LASs. The "Outstanding" rating for Contextualization has a mean score of 3.82 which indicates the LASs' adaptability to diverse learners and contexts, aligning with the growing emphasis on culturally responsive and inclusive pedagogy.

The overall evaluation result obtained a mean score of 3.82, highlighting the exceptional quality of the contextualized Learner Activity Sheets. These findings strongly support their continued use and dissemination to enhance learning outcomes in diverse educational settings.

Table 3 presents the evaluation results conducted on the Teacher Activity Guide (TAG), a key component of the Contextualized Instructional Materials (CIMs). The consistently high ratings across all criteria demonstrate the Teacher Activity Guide's (TAG) strong alignment with established quality standards.

The "Outstanding" rating for content, with a mean score of 3.84, confirms that the TAG delivers comprehensive, accurate, and relevant information, effectively supporting teachers in their instructional delivery. This is consistent with research emphasizing the importance of teacher guides in providing clear and thorough guidance for effective lesson implementation. The "Outstanding" rating for structure and coherence with a mean score of 3.80 indicates that the TAG is logically organized and easy to follow, facilitating teachers' understanding and use. This is supported by research highlighting the importance of a clear and coherent structure in instructional materials to enhance usability and effectiveness.

The high rating for learning activities a mean score of 3.92, signifies that the TAG incorporates a variety of engaging and relevant activities that foster active learning and student participation. This echoes research demonstrating the positive impact of active learning on student engagement and achievement. The "Outstanding" rating for usefulness with a mean score of 3.86, signifies that teachers perceive the TAG as a valuable and practical resource for their daily practice. This is consistent with research emphasizing the importance of teacher guides as tools for facilitating effective teaching and learning (Remillard, 2005). While still rated as "Outstanding," the score for general appearance and organization, with a mean score of 3.68, was the lowest among the criteria. This suggests a potential area for minor improvements, such as enhancing the visual appeal or streamlining the organization of content. This aligns with research suggesting that the visual design and organization of instructional materials can impact their perceived usability and effectiveness [73].

The "Outstanding" rating for contextualization obtained a mean score of 3.84, indicating that the TAG is culturally relevant and tailored to the specific needs and contexts of the target learners. This is consistent with research emphasizing the importance of culturally responsive pedagogy in promoting equitable learning outcomes. The general evaluation results obtained an overall mean of 3.80, providing compelling evidence of the high quality and effectiveness of the Teacher Activity Guide. The findings underscore the importance of investing in well-designed teacher guides as essential tools for supporting effective teaching and learning.

The evaluation results for the lesson plan are presented in Table 3, detailing the mean scores and corresponding verbal interpretations for each criterion. The consistently high mean scores across all criteria, ranging from 3.92 to 3.98, indicate the Lesson Plan's exceptional quality. These scores fall

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within the "Outstanding" category, affirming the material's alignment with rigorous standards of instructional design.

The "Outstanding" rating for Content has a mean score of 3.98, which signifies that the Lesson Plan's subject matter is comprehensive, accurate, relevant, and curriculum-aligned. The high score for Structure and Coherence with a mean score of 3.96, suggests the Lesson Plan exhibits a logical progression of activities, clear objectives, and well-defined transitions. This aligns with studies highlighting the importance of coherent structure in facilitating student comprehension and engagement. The "Outstanding" rating for Learning Activities has a mean score of 3.92, which indicates that the Lesson Plan incorporates diverse, engaging, and interactive tasks that cater to varied learning styles. This resonates with the emphasis on active learning in contemporary pedagogy.

The "Outstanding" score for Usefulness, with a mean score of 3.92, underscores the Lesson Plan's perceived value and applicability in real-world classrooms. This finding aligns with research emphasizing the importance of practicality and relevance in instructional materials. The high rating for General Appearance and Organization with a mean score of 3.94, suggests the Lesson Plan is visually appealing, well-formatted, and easy to navigate. This reflects the significance of aesthetics and user-friendliness in enhancing the instructional experience [73].

The "Outstanding" score for Contextualization, with a mean score of 3.94, signifies the Lesson Plan's cultural relevance and responsiveness to the diverse needs of learners. This finding aligns with the growing emphasis on culturally responsive pedagogy. The overall evaluation results have an overall mean score of 3.80, underscoring the Lesson Plan's exceptional quality and affirming its alignment with research-based principles of effective instructional design. The consistently high scores across all criteria suggest the material's potential to enhance teaching and learning outcomes significantly.

The consistently outstanding evaluation of the contextualized instructional materials, underscores the pivotal role of teachers' assessment in ensuring the quality and effectiveness of instructional resources. Their feedback, rooted in practical classroom experience and pedagogical expertise, validates the alignment of the materials with established instructional design principles and standards. This evaluation not only confirms the Lesson Plan's potential to enhance student engagement and learning outcomes but also highlights the importance of incorporating teachers' perspectives in the ongoing development and refinement of contextualized instructional materials. By recognizing and valuing teachers' expertise, educational stakeholders can foster a collaborative approach to instructional design that ultimately benefits both educators and learners.

The results of the students' evaluation of the contextualized instructional materials (CIMs), as presented in Table 4, reveal an outstanding level of satisfaction across all criteria for both modules and learner activity sheets. The mean ratings for each criterion ranged from 3.94 to 3.99, surpassing the threshold for an outstanding rating (3.51-4.00).

Table 4.
Students' evaluation of the contextualized instructional materials

CIMs	Criteria	Mean	Verbal interpretation
Module			
	Content	3.96	Outstanding
	Structure and coherence	3.97	Outstanding
	Learning activities	3.95	Outstanding
	Usefulness	3.96	Outstanding
	General appearance and organization	3.98	Outstanding
	Contextualization	3.94	Outstanding
Overall mean		3.96	Outstanding
Learner activity sheet			
	Content	3.99	Outstanding

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	Structure and coherence	3.99	Outstanding
	Learning activities	3.96	Outstanding
	Usefulness	3.98	Outstanding
	General appearance and organization	3.98	Outstanding
	Contextualization	3.95	Outstanding
Overall mean		3.97	Outstanding

Note: Interpretation is based on the following scale: 3.51 – 4.00 Outstanding, 2.51 – 3.50 Very Satisfactory, 1.51 – 2.50 Satisfactory, 1.0 – 1.50 Unsatisfactory; N=34

The evaluation of the modules revealed an overwhelmingly positive response. With a mean rating of 3.96 across all criteria, students consistently rated the modules as "Outstanding." This high level of satisfaction resonates with findings from prior research, which has shown that content relevance and engaging activities are key factors in enhancing student engagement [8]. Specifically, the module's content received an average rating of 3.96. This indicates that students found the subject matter relevant, informative, and well-aligned with their learning needs. The structure and coherence of the modules also garnered an impressive mean score of 3.97, signifying that the logical flow and organization of the content facilitated comprehension and knowledge acquisition.

The learning activities integrated into the modules were deemed "Outstanding" with a mean score of 3.95. This highlights the effectiveness of interactive and hands-on experiences in promoting active learning and deeper understanding [124]. Embedding real-world applications into science education can foster critical thinking and problem-solving skills [123]. The perceived usefulness of the modules, with a mean score of 3.96, underscores their practical value in enabling students to apply their knowledge in real-world contexts.

The general appearance and organization of the modules also received high praise, with a mean score of 3.98. This suggests that the visual appeal and user-friendly layout of the materials contributed to a positive learning experience. Notably, the contextualization of the modules, rated 3.94, demonstrates the successful integration of culturally relevant and locally specific content, a factor that has been shown to enhance student motivation and achievement.

The learner activity sheets (LAS) mirrored the success of the modules, with an overall mean rating of 3.97, classified as "Outstanding." The LAS content garnered a near-perfect mean score of 3.99, underscoring its exceptional quality, relevance, and alignment with learning objectives. Similarly, the structure and coherence of the LAS were deemed "Outstanding" with a mean score of 3.99, signifying a well-organized and easy-to-follow format.

The learning activities embedded within the LAS were rated 3.96, affirming their effectiveness in promoting active engagement and knowledge application. The perceived usefulness of the LAS, rated 3.98, highlights its practical value in reinforcing learning and facilitating skill development. The general appearance and organization of the LAS, with a mean score of 3.98, further contributed to a positive and productive learning experience.

The contextualization of the LAS, rated 3.95, reflects the successful integration of relevant and meaningful contexts, enhancing the materials' appeal and relevance to students' lives and experiences. This finding aligns with research emphasizing the importance of culturally responsive pedagogy in fostering inclusivity and equity in education. The findings also underscore that innovations such as contextualization are crucial to nation-building and development; they reinforce growth and positive change [123].

The overwhelmingly positive student evaluations of both the modules and LAS attest to the effectiveness of contextualized instructional materials in enhancing learning outcomes. The consistently high ratings across all criteria highlight the comprehensive quality of the materials, encompassing content relevance, structure, engagement, usefulness, and contextualization.

These findings have significant implications for educational practice. They underscore the importance of designing instructional materials that are not only informative and well-organized but

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also engaging, relevant, and culturally responsive. The integration of interactive activities, real-world applications, and locally specific content emerges as a key strategy for promoting active learning, deeper understanding, and enhanced student motivation.

The success of the contextualized instructional materials in this study provides compelling evidence for their continued development and implementation. As educators strive to create inclusive and equitable learning environments, the use of culturally responsive pedagogy and contextualized materials emerges as a powerful tool for empowering all students to reach their full potential.

4. Conclusions and Recommendations

This study highlights the importance of contextualized instructional materials in enhancing Science education. It identifies a gap in students' understanding of solution concentrations and suggests the need for targeted interventions to improve practical application. The Science 7 module integrates diverse instructional design models, demonstrating the potential for engaging and compelling learning experiences. The study validates contextualized instructional materials centered on the Blue Porterweed, which effectively addressed the least mastered competency in expressing solution concentrations among Grade 7 students. The materials align with curriculum standards, have high quality, and receive positive feedback from teachers and students. The systematic implementation of these materials, as evidenced by pilot testing and classroom application, shows their effectiveness in engaging students and enhancing their understanding of solution concentration. The study emphasizes the potential of using locally available resources and a structured instructional design process to improve teaching and learning outcomes. The materials' effectiveness in enhancing student learning and engagement, aligning with curriculum standards, and fostering critical thinking, further emphasize their potential contribution to Science education.

The use of a module, learner activity sheets, teacher activity guide, and lesson plan featuring the Blue Porterweed plant has shown significant improvement in student learning outcomes. To maximize benefits, students should engage in hands-on activities, ask questions, participate actively in class discussions, connect learned concepts to real-life experiences, and appreciate local biodiversity. Teachers can incorporate these materials into lesson plans, and curriculum developers should collaborate with teachers and local communities to identify relevant resources. Science educators can attend professional development workshops on contextualized teaching and learning. Future research should investigate the long-term impact of these materials, explore different approaches, and assess their impact on students from diverse backgrounds.

5. Implication

The successful development and implementation of contextualized instructional materials featuring the Blue Porterweed plant demonstrate the potential of this approach to enhance Science education. The positive outcomes of this study suggest that incorporating locally relevant resources into the curriculum can significantly improve student engagement, learning, and overall academic performance. This approach holds promise for broader application across different subject areas and grade levels.

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