



RESEARCH PAPER

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A contextualized coursebook in statistics and probability: Visualizing the environmental and cultural phases of Ilocos Region, Philippines

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Key words: Coursebook evaluation, Statistics and probability education, Contextualized learning, Ilocos region culture, Reading comprehension level

Abstract

This research paper presents an analysis of the validity of a constructed Coursebook in Statistics and Probability designed for Grade XI students. The Coursebook incorporates examples, illustrations, and exercises that are contextualized around the environmental conditions, products, culture, events, and issues of the Ilocos Region. Research and development methods were employed during the construction process of the Coursebook. To evaluate its effectiveness, the Coursebook was assessed based on Content, Format, Presentation and Organization, Accuracy, and Up-to-datedness. The evaluation revealed that the Coursebook excelled in all areas, receiving a general descriptive rating of Very Satisfactory. In addition to the overall assessment, the readability of the material was analyzed using the Flesch Reading Ease score. The score obtained was 66.88, indicating a Standard/Average level of readability. This suggests that the material can be easily comprehended by eighth and ninth-grade students. This finding is further supported by indicators such as the Gunning Fog Index, Smog Index, Coleman Liau Index, Flesch Kincaid Grade Level, and Automated Readability Index, all of which suggest that the material is accessible to students in Grades six and seven. The positive evaluation results and the appropriate readability level, it is highly recommended that the Coursebook in Statistics and Probability be utilized as a reference for both teachers and students in schools. The contextualization of the examples and exercises within the Ilocos Region products, culture, events, and issues not only enhances students' understanding of statistics and probability but also fosters a connection between the subject matter and their local environment. By incorporating this Coursebook into the curriculum, educators can effectively engage students in the learning process while promoting an appreciation for their regional context. By integrating local context and regional knowledge into the learning materials, the Coursebook offers a unique opportunity to foster a deeper understanding of the region's biodiversity and environmental challenges among Grade XI students.

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Introduction

Integrating the study of statistics and probability with thematic environmental themes offers numerous benefits in promoting environmental literacy, fostering sustainable attitudes, and enhancing students' understanding of real-world environmental challenges. Several studies have highlighted the positive impact of contextualized learning and environmental education on students' environmental awareness and conservation behaviors. According to Anderson (2010), incorporating real-life examples and local context in the curriculum enhances students' engagement and interest in learning, making the subject matter more relevant and relatable. Similarly, Kato-Nitta *et al.* (2015) found that integrating environmental themes into mathematics education improved students' problem-solving skills and critical thinking, as they were required to analyze environmental data and make informed decisions. By integrating statistics and probability concepts within environmental contexts, students not only gain essential analytical and mathematical skills but also develop a deeper appreciation for the interconnectedness of environmental systems. This approach aligns with the principles of Education for Sustainable Development (ESD), as proposed by UNESCO, which emphasizes the integration of sustainable development issues into all aspects of education. By adopting this pedagogical approach, educators can contribute to cultivating environmentally responsible citizens who are equipped to address complex environmental challenges and contribute to a more sustainable future.

This study aimed to develop a contextualized coursebook in Elementary Statistics and Probability visualizing Ilocos Region Philippines. The Coursebook that was developed was intended for the students enrolled in the said subject. The status of the material was evaluated along with Content, Format, Presentation and Organization, Accuracy, and Up – to – datedness of Information. Moreover, the level of validity and readability of the material were also considered.

Schools can adjust curriculum to local conditions and connect teaching and learning to the local

environment, according to Taylor (as stated in Bringas, 2014). The Enhanced Basic Education Act of 2013 Rule II Section 10.2 states that the following requirements for the curriculum must be met: (1) relevance, responsiveness, and research-based; (2) gender- and culture-sensitive; (3) contextualized and global; and (4) flexibility to allow the school to localize and enhance the curriculum in accordance with their respective educational and social contexts. The program seeks to promote the creation and production of regional materials in accordance with Section 10.3 of the same Act. The materials shall be approved by the regional and division offices by the national policies and standards.

The following crucial reminders are provided by Bringas (2014): 1. All learning sections allow for localization and contextualization; 2. Localization makes the most of the resources, events, activities, and problems that are already present in the area; 3. Teachers must anchor their lessons in the learners' lives and use authentic resources in order to contextualize.

Each pupil is unique since they all come from various backgrounds. In order to foster diversity in the classroom, according to Freire (as cited in Lee *et al.*, 2012), teachers must be aware of the various backgrounds of their pupils. To solve this, teachers must be aware of the cultural backgrounds of their pupils for the good of the entire class. Culturally contextualized instruction, according to Ozele (as stated in Lee & Yee-Sakamoto, 2012), encourages students to learn more about their own cultural history and to respect and comprehend that of others.

Karset & Sivesind (2010) claim that the current issues in numerous nations illuminate conversations regarding the significance of enhancing national cultures as a general objective of the curriculum. The National Achievement Test in mathematics for the academic year 2011–2012 had an average high school score of 46.37, according to the Philippine National Educational Testing and Research Center (2013). This result is below the 75.00 passing rate. This shows how poorly our students have done in math.

Young *et al.* (2012) contend that the solution to this issue is to discover a means to make mathematics meaningful to children in order to inspire them to learn the subject. Numerous organizations, including the National Council of Teachers of Mathematics and the National Research Council have urged adding "real world" examples and contextualizing mathematics in textbooks. According to the NCTM's connection criterion, "Instructional programs from pre-kindergarten through grade 12 should enable students to recognize and apply mathematics in contexts outside of mathematics." By connecting ideas and concepts from different courses, contextualization accomplishes this goal and can be thought of as a type of "deep learning" (Moltz, 2010).

Operationally, contextualized instruction can be characterized in a variety of ways. Contextualized instruction, according to Spring (2010), refers to instruction that is grounded in the learners' cultures and real-world experiences. According to Bird, Livesey, and Simon (2011), contextualized teaching is an instructional method that focuses on giving the lesson directly on actual applications in a particular environment to pique the students' attention. Contextualized teaching, according to Mazzeo *et al.* (as stated in Perin, 2011), is a strategy for putting the subject matter in a significant and pertinent context.

The discussion board posts by the participants revealed that the learner-content mismatch, lack of context and material relevance, difficulties deciphering the lesson plans, attendance patterns, and time restrictions were the most obstacles to implementing the curriculum. Several elements of the high-level contextualized curriculum had a favorable impact on adult learners and instructions despite the many obstacles. These factors were typically potent enough to get beyond the aforementioned obstacles (Showalter *et al.*, 2015).

According to Safran (as cited in Karakas & Karaka, 2011), using materials in the classroom may increase the productivity of the teacher in terms of quality and quantity. Using instructional materials in the

classroom may facilitate learning because the students have materials to use that motivate them to study and guide them in their journey with the course (Mazgon & Stefanc, 2012).

Cognizant of the scenario and motivated by the desire of the researcher to effect better delivery of goods coupled with the drive to contribute something substantial to the pool of knowledge in his specialization, the researcher intends to develop a contextualized and localized coursebook in Statistics and Probability for Grade XI Senior High School. This move patronizes the Implementing Rules and Regulations of the Enhanced Basic Education Act of 2013 Rule II Section 10.3, which refers to producing and developing locally produced teaching and learning materials. The developed Coursebook may serve as an additional reference for teachers and students. This may lessen teachers' difficulty in constructing examples, illustrations, and exercises in the local context. Also, the course may contribute to the success of the K-12 program in the Philippines.

The integration of environmental and biodiversity thematic elements in the study of elementary statistics and probability is a powerful educational approach that holds significant benefits for students, educators, and society as a whole. Firstly, this integration enhances the relevance and real-world applicability of statistics and probability concepts. By contextualizing these mathematical principles within environmental themes, students can better grasp the significance of data analysis, inference, and predictions in understanding and addressing pressing environmental issues. For example, analyzing biodiversity data, such as species distribution patterns or habitat changes, can allow students to draw meaningful conclusions and make informed decisions to support conservation efforts. This experiential learning approach not only fosters critical thinking and problem-solving skills but also instills a sense of environmental responsibility and empathy for nature, preparing the next generation to be environmentally conscious citizens and future stewards of the planet. Secondly, the integration of

environmental and biodiversity themes enriches the learning experience by making it interdisciplinary and interconnected. It allows students to see the interplay between scientific knowledge, data analysis, and environmental decision-making.

According to research by Tilbury *et al.* (2017), integrating sustainability and environmental themes across different subjects, including mathematics, fosters a sense of interconnectedness and systems thinking. Students learn to recognize that environmental issues are multifaceted and require collaborative solutions that involve various disciplines. This interdisciplinary learning fosters a broader perspective and encourages students to see the intrinsic value of biodiversity and the environment in promoting ecological balance and human well-being. Overall, the integration of environmental and biodiversity thematic elements in the study of elementary statistics and probability not only enhances students' mathematical skills but also cultivates a generation of environmentally conscious and scientifically literate individuals capable of contributing to a sustainable future.

Goal of Mathematics Curriculum to Produce Environmentally Conscious Learners

The K-12 goal of the Mathematics curriculum in the Philippines is to produce students who are "Makakalikasan," which translates to being environmentally conscious or nature-oriented. This goal is aligned with the broader vision of the K-12 education system to foster holistic development among learners, emphasizing the importance of environmental stewardship and sustainability. In the context of Mathematics education, the goal of producing "Makakalikasan" learners involves integrating environmental themes and contexts into the teaching and learning of Mathematics. It aims to demonstrate to students the practical application of mathematical concepts in understanding and addressing environmental issues. By contextualizing mathematical problems and exercises around environmental challenges, students develop a deeper understanding of Mathematics' relevance in real-world scenarios.

The "Makakalikasan" goal also entails nurturing critical thinking and problem-solving skills among students to analyze environmental data, interpret statistical information related to biodiversity, climate change, and ecological trends, and make informed decisions for environmental conservation. By connecting Mathematics with the environment, students learn to appreciate the impact of human actions on nature and the importance of sustainable practices. Furthermore, the goal encourages students to become active agents of change in their communities and the world at large. By instilling an environmental consciousness at a young age, students are motivated to take responsible actions to protect the environment and advocate for sustainable practices. As future citizens, they are empowered to contribute positively to environmental initiatives and make environmentally conscious decisions in their personal and professional lives. The K-12 goal of the Mathematics curriculum to produce "Makakalikasan" aligns with the vision of nurturing environmentally conscious and responsible individuals. By integrating environmental themes into Mathematics education, students develop a deeper appreciation for the role of Mathematics in addressing environmental challenges and become proactive agents of positive change for a sustainable future.

The Framework of the Study

The capsules in the funnel are the learning theories. The development of the material was based on the said theories of learning. The bars above the funnel are the concepts, insights, and ideas concomitant to the said theories. There are exercises/drills which are localized in the region that promote and enhance love of the country, pride in being a Filipino, respect for the environment, and a high level of self-efficacy. The material is designed to have activities (group projects), making groups of students work together to develop teamwork, cooperation, respect, and trustworthiness among the members. Also, the material is intended to have application in a more profound sense and performance task to reinforce, explore, enhance, and develop students' creative and critical thinking, productive work, scientific attitude,

and reasoning, and create/construct new things based on their previous knowledge.

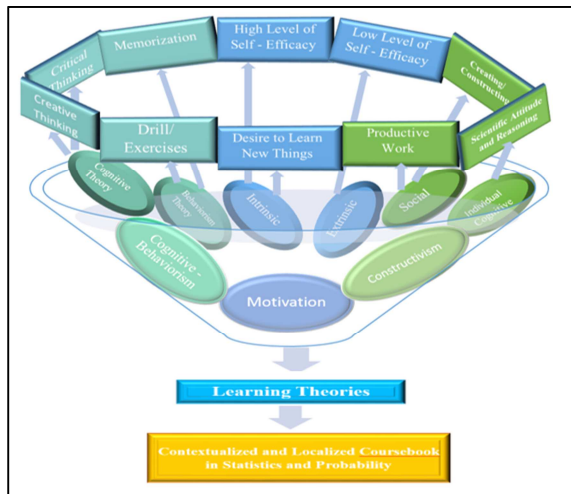


Fig.1. Learning Theories, Concepts, Insights, and Ideas.

According to Lee and Sakamoto (2012), learning takes place in the complex daily realities of human life in contact with the immediate personal setting and the macro environment rather than taking place in a vacuum. Teachers must use teaching techniques that take into account the cultures and settings of their pupils if they are to enable effective learning in the classroom. Shuell (2013) asserts that education is the most fundamental human activity. Learning might take place inside or outside of the classroom. Despite the fact that most learning takes place outside of the classroom, it is at the center of the educational process.

The following learning theories were used as a collective framework by the researcher to create the suggested course book. The Cognitive-Behaviorism Theory is one of these theories. According to Innovative Learning-Behaviorism (quoted in Walker & Moore, 2013), learning is defined as a "semi-permanent change in behavior," which means that if the learners' conduct significantly improves, learning has taken place. According to McLeod (2016), the human mind is a "tabula rasa" (empty slate) at birth and that learning is significantly influenced by the environment. All human actions are picked up from their environments or those that are based after them. Memorization and drills/exercises are two ways to train the human mind.

Another sort of learning theory that emphasizes contextualized teaching and learning is motivation theory. According to Kelemen (2014), there are two main categories of motivations for students to attend school: (1) extrinsic motivation, which occurs when a student enters a classroom without a direct interest in the material being taught in exchange for direct or indirect rewards, particularly moral ones; and (2) intrinsic motivation, which occurs when a student is motivated by their own interest in learning and gaining knowledge. According to Moldovan, Ignat, and Bălas-Timar (2011), curiosity, or the desire to learn more, lies at the heart of intrinsic motivation. When curiosity is coupled with cultural values—which enable communication with others and offer a plethora of experiences, sources of knowledge, and opportunities—it becomes permanent, satisfaction and equanimity.

Constructivism is another learning theory that highlights the implication of contextualized teaching and learning. Constructivism – particularly in its "social" forms – suggests that the learner should be encouraged to explore their previous knowledge by creating (“constructing”) using active techniques like experimentation and real word problem solving to create more knowledge (Atherton, 2014). The students should be guided to work productively by the teacher to address the needs of their preexisting knowledge (Women’s Network for Entrepreneurial Training, 2016). According to Butin (2014), the Theory of Constructivism by Jean Piaget states the following: (1) Learning is an active rather than passive process, and (2) Learning should be whole, authentic, and “real” to be effective.

The inputs of this study are the following (1) DepEd curriculum guide for grade 11 Statistics and Probability specifying the minimum competencies required for this course. (2) DepEd validation instrument for Print supplementary materials. This instrument is composed of an evaluation sheet and the indicators of the factors given. Also, this instrument shows the area of the coursework to be validated and the minimum score that the instrument must attain to pass the validation process.

(3) DepEd Order No. 43, s. 2013. Implementing Rules and Regulations (IRR) of Republic Act No. 10533, Otherwise Known as the Enhance Basic Education Act of 2013.

The validation of the proposed coursebook based on its content, format, presentation, and organization, as well as the accuracy and timeliness of the information, is represented by the center arrow. Following the course book's validation, the next phase entails a re-examination of the relevant section(s) in order to take into account the expert evaluators' recommendations and comments.

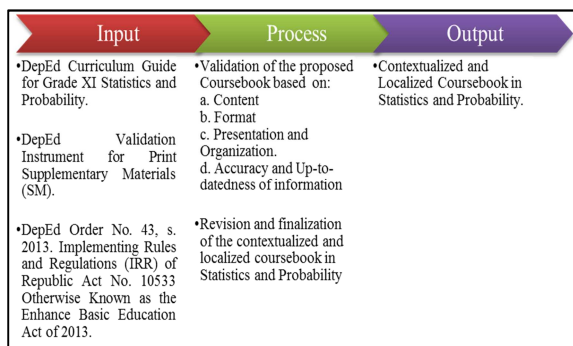


Fig 2. The Research Paradigm.

Materials and methods

Research Design

The researcher employed the Research and Development, also known as the Research-Based Development Methodology, in this investigation. Educational research and development is described by Borg and Gael (as stated in Larang, 2013) as a procedure used to create and validate educational goods. Products include tangible items like books, worktext, workbooks, modules, and other things. Additionally, it aims to build protocols and procedures, such as instructional organizing strategies.

Instrumentation and Data Collection

For the DepEd level 2 evaluation rating sheet for print supplementary materials (S.M.), this study used a questionnaire. The questionnaire was divided into two sections: the evaluation rating sheet, which contains the four components, and the various indicators of the four factors, each of which contains the criteria for assessing the item. Content, Format, Presentation and

Organization, and Accuracy and Up-to-Dateness of Information were all discovered in the questionnaire.

Procedure

The examples and exercises of the proposed contextualized and localized Coursebook in Statistics and Probability were based on the Ilocos Region facts and fig.s. The researcher gathered information on the different provinces of the Region by visiting government agency websites, watching T.V., and reading newspapers. The gathered information was used in the development of the course book. Based on the collected issues, events, authenticated materials, and activities about the Region, the researcher constructed problems that were used as examples and exercises in the Coursebook. The constructed Coursebook was evaluated by teachers from State Universities and Colleges and the Department of Education. The evaluators are living in the Region, and they are teaching Statistics and Probability.

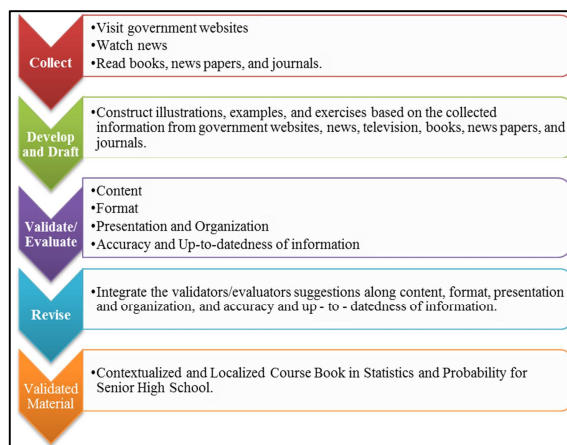


Fig. 3. Flowchart for the Construction of the Proposed Contextualized and Localized Coursebook in Statistics and Probability.

Analysis of Data

The status of the material, along with Content, Format, Presentation and Organization, Accuracy, and Up to dates were determined using counting. The range of scores below was adopted in the DepEd Rating Sheet for Print Supplementary Materials.

The legitimacy of the coursebook was evaluated together with its substance, format, presentation, organization, accuracy, and timeliness of the information.

Coursebook Features	Status
Content	21 and Above Passed Below 21 Failed
Format	54 and Above Passed Below 54 Failed
Presentation and Organization	15 and Above Passed Below 15 Failed
Accuracy and Up to datedness of Information	18 and Above Passed Below 18 Failed
Over-all	108 and Above Passed Below 108 Failed

The readability rating of the Coursebook was determined using the tool Test Document Readability- Online Utility. The grade level of the reader's comprehension of the material was determined using the Gunning Fog Index, Coleman Liau Index, Flesch Kincaid Grade Level, Automated Readability Index (ARI), and Smog Index. The software automatically displays the grade level of each person who can understand the material.

Results and discussion

The material was divided into ten chapters (i.e., Introduction to Statistics, Presentation and Summarizing, Data Description, Counting Sample Space and Probability, Normal Random Variables, Sampling and Sampling Distribution, Estimation of Parameters, Hypothesis Testing, Test other Hypothesis, Analysis of Variance and Correlations and Linear Regression). Each section of every chapter is equipped with a discussion of the concomitant concepts, examples, and activities. Chapter exercises consisted of Written Problem Solving with two levels, Each chapter of the Coursebook starts with a course outline and learning competencies based on the Statistics and Probability curriculum guide, followed by a concept map that shows the organization of the discussion. Each chapter also contains real-life scenarios to reinforce the readers' behavior to study the whole chapter. This feature as well shows a brief description of the possible queries in each chapter. Definitions, theorems, corollaries, and formulas are presented in easy-to-locate boxes. Exercises are classified into three levels. Also, the book provides procedures and a step-by-step solution for every example, and each concept is illustrated with at least one example. Most of these problems are real-life scenarios in the region.

Status of the Coursebook along the Different Features

For its contribution to the achievement of specific objectives of the subject area and grade/year level it is created for as well as the promotion of the development of desirable values and characteristics, the material received a four, which is the highest possible score, as shown in Table 1. The information's capacity to support the development of higher cognitive talents, such as critical thinking, creativity, learning by doing, inquiry, problem-solving, etc., came in second, receiving a score of 3.9 for each. The content obtains the lowest score for the absence of ideological, cultural, religious, racial, and gender biases and prejudices. The overall content score of the piece is 27, which is better than 21. This suggests that the information passed validation in addition to the content.

Table 1. Status of the Coursebook along with Content.

Content	Mean Score	Status
1. Suitability to student's level of development	3.9	Passed
2. Contribution to achieving specific objectives	4.0	Passed
3. Development of higher cognitive skills	3.9	Passed
4. Freedom from ideological, cultural, religious, racial, and gender biases and prejudices	3.6	Passed
5. Enhancement of desirable values and traits	4.0	Passed
6. Interest arousal in the target reader	3.8	Passed
7. Provision of adequate warning/cautionary notes	3.7	Passed
Total	27.0	Passed

The table 2 presents an evaluation of a coursebook that integrates environmental and biosciences themes as learning activities. The coursebook focuses on various environmental themes and their connections to probability and statistics concepts. The evaluation includes the teaching approach used for each theme, the mean rating, and the interpretation of the ratings. The evaluation indicates that the coursebook's integration of environmental and biosciences themes with probability and statistics concepts has been successful. The "Interesting" interpretation across all themes and the overall mean rating of 3.72 signify that the students found

the coursebook engaging and informative. The approach of using real-world data, promoting discussions, and encouraging critical thinking has undoubtedly contributed to the effectiveness of the learning activities. Overall, this coursebook appears

to be a valuable resource for students to develop a deeper understanding of environmental challenges and how statistical analysis can be applied to address them, fostering a greater sense of environmental stewardship and responsibility.

Table 2. Evaluation on the Coursebook with the Integration of Environmental and Biosciences Themes as Learning Activities.

Environmental Themes	Probability and Statistics Concepts	Teaching Approach	Mean	Interpretation
Impact of Pollution on Ecosystems	Data analysis of pollutant levels in water, air, and soil	Collect real-world data on pollution levels and analyze trends. Understand how pollutants affect ecosystems of llocos.	3.6	Interesting
Climate Change and Extreme Events	Probability of extreme weather events (e.g., hurricanes, droughts)	Use historical weather data to calculate probabilities of extreme events. Discuss the link between climate change and these events.	3.8	Interesting
Biodiversity and Species Loss	Descriptive statistics of species populations	Examine population data to understand trends in biodiversity loss. Discuss the implications of declining species diversity.	3.9	Interesting
Sustainable Resource Management	Probability of resource depletion and regeneration	Analyze data on resource usage and regeneration rates. Discuss strategies for sustainable resource management.	3.7	Interesting
Recycling and Waste Reduction	Probability of proper waste disposal and recycling	Collect data on waste disposal habits and recycling rates. Calculate probabilities to motivate proper waste management.	3.6	Interesting
Renewable Energy Sources	Statistical analysis of energy production and consumption	Compare renewable energy data with non-renewable sources. Discuss the benefits of renewable energy for the environment.	3.7	Interesting
Environmental Policy Evaluation	Probability and statistics in policy impact assessment	Use data to evaluate the effectiveness of environmental policies. Encourage critical thinking about policy implications.	3.9	Interesting
Environmental Footprint	Probability of individual environmental impacts	Calculate the environmental footprint of daily activities. Encourage lifestyle changes to reduce impact.	3.6	Interesting
Total			3.72	Interesting

The table presents an evaluation of a coursebook that skillfully integrates environmental and biosciences themes with probability and statistics concepts. The coursebook appears to have been well-designed, covering various important environmental topics and their connections to statistical analysis. The evaluation includes the teaching approach used for each theme, the mean rating for all themes, and an interpretation of the ratings. The mean rating for all the environmental themes combined is 3.72, which is reasonably high and indicates that the students found the coursebook content engaging and valuable. The interpretation "Interesting" is consistently provided

for each theme, suggesting that the students were intrigued by the content and actively participated in the learning activities.

The coursebook effectively addresses different environmental challenges, such as the impact of pollution on ecosystems, climate change, biodiversity loss, sustainable resource management, recycling and waste reduction, renewable energy, environmental policy evaluation, and individual environmental footprints. Each theme is connected to probability and statistics concepts, enabling students to gain a deeper understanding of these environmental issues

through data analysis and critical thinking. One of the coursebook's strengths is the incorporation of real-world data analysis, which allows students to examine pollution levels, weather data, species populations, resource usage, waste disposal habits, energy production, and environmental policies. By working with real data, students are encouraged to develop practical skills in statistical analysis and become more aware of the environmental challenges facing their region, specifically in Ilocos.

Table 3. Status of the Course Book along with Format.

Format	Mean Score	Status
Prints		
1.1 The size of the letters is appropriate to the intended users	4.0	Passed
1.2 Spaces between letters and words facilitate reading	4.0	Passed
1.3 Font is easy to read	4.0	Passed
1.4 Printing is of good quality (i.e., no broken letters, even density, correct alignment, properly placed screen registration)	3.5	Passed
Total Score	17.5	Passed
Over-all Mean	3.9	
Illustrations		
2.1 Simple and easily recognizable	3.7	Passed
2.2 Clarify and supplement the text	4.0	Passed
2.3 Properly labeled or captioned (if applicable)	3.8	Passed
2.4 Realistic/appropriate colors	4.0	Passed
2.5 Attractive and appealing	3.9	Passed
Total Score	23.3	Passed
Over-all Mean	3.9	
Design and Layout		
3.1 Attractive and pleasing to look at	4.0	Passed
3.2 Simple (i.e., does not distract the attention of the reader)	4.0	Passed
3.3 Adequate illustration of the text	4.0	Passed
3.4 Harmonious blending elements (e.g., illustrations and texts)	4.0	Passed
Total Score	16	Passed
Over-all Mean	4.0	
Paper and Binding		
4.1 Paper used contributes to easy reading	3.7	Passed
4.2 Durable binding to withstand frequent use	3.9	Passed
Total Score	7.6	Passed
Over-all Mean	3.8	
Size and Weight of SM		
5.1 Easy to handle	4.0	Passed
5.2 Relatively light	4.0	Passed
Total Score	8.0	Passed
Over-all Mean	4.0	
Grand Total Score	72.8	Passed

Furthermore, the teaching approach emphasizes discussions and critical thinking, fostering an active and engaging learning environment. By encouraging students to explore the implications of environmental issues and policies, the coursebook not only builds their statistical skills but also nurtures their ability to think critically and make informed decisions regarding environmental conservation and sustainability. Table 3 revealed that the material scored best in the Design and Layouts and Size and Weight because these categories had the highest mean, followed by Prints and Illustrations. The material scored lowest in the Paper and Bindings with a mean of 3.8 because the validators concurred that some indicators were not applicable or useful. Moreover, the material scores 17.5, 23.3, 16.0, 7.6, and 8.0 for the areas of prints, illustrations, design, layouts, paper and binding, and size and weights, respectively, which are higher than 12, 18, 12, 6, and 6. The overall score of the material along format is 72.4, which is more than 54. This result corroborates the excellent feedback of the validators to the five indicators under it.

According to Table 4, the item received a four out of four for Indicator 1 (presentation is intriguing, engaging, and intelligible). Then, indications four (sentence length is appropriate for the target reader's comprehension level) and five (sentence and paragraph structures are interesting to the target reader) came next, each scoring 3.9.

Table 4. Status of the Coursebook along with Presentation and Organization.

Criteria	Mean Score	Status
1. The presentation is engaging, interesting, and understandable.	4.0	Passed
2. There is a logical and smooth flow of ideas.	3.7	Passed
3. The vocabulary level is adapted to target the reader's experience and understanding	3.8	Passed
4. The length of the sentence is suited to the comprehension level of the target reader.	3.9	Passed
5. Sentences and paragraph structures are varied and interesting to the target reader	3.9	Passed
Overall Score	19.3	Passed

The content received a score of 3.7 for indicator two (there is a logical and fluid flow of ideas). Together with Presentation and Organization, the item received an overall grade of 19.3, which is higher than 15. The information apparently passed the organization, presentation, and coursebook validation tests.

Table 5 depicts that the material got the highest score of 3.8 in the indicator "computational errors," followed by "factual errors" and "grammatical errors," each with a score of 3.7. The material scored low in the indicator "typographical and other minor errors," with a score of 3.1. The overall score of the material, along with the Accuracy and Up – to – datedness of Information, is 21.3, which is more than 18. Based on this result, it can be concurred that the six indicators used by the validators are generally minimal and few.

Table 5. Status of the Coursebook along with Accuracy and Up to dates of Information

Here's the transformed table with improved formatting:

Criteria	Score	Status
Conceptual errors	3.6	Passed
Factual errors	3.7	Passed
Grammatical errors	3.7	Passed
Computational errors	3.8	Passed
Obsolete information	3.4	Passed
Typographical and other minor errors (e.g., inappropriate or unclear illustrations, missing labels, wrong captions, etc.)	3.1	Passed
Overall Score	21.3	Passed

The information presented in the material was gathered from Philippine government agency websites. The government agencies' latest information and report updates were also integrated into the random selection by the time the Coursebook was developed to produce holistic and updated material. The errors found by the validators in the material were also highly considered. Most of the suggestions were followed, which eventually improved and refined the material in its entirety.

Level of Validity of the Coursebook along the Different Features

Table 6 revealed the mean and descriptive rating of each feature of the material. The material garnered a very satisfactory level of validation in all the areas

presented. Among the features of the material, the format garnered the highest rating of 3.91, with a descriptive evaluation of very satisfactory. This was followed by presentation and Organization with a mean of 3.86 and a descriptive evaluation of very satisfactory. Generally, the material garnered a descriptive rating of very satisfactory. This implies that the Coursebook is deemed suitable and contributory to achieving the objectives, addressing higher cognitive skills, interest–arousing, attractive and appealing, culturally relevant, and covering new and relevant information useful to the target readers.

The Coursebook was also noted for its appropriate letter sizes, adequate illustrations, ease of reading, high-quality printing, lack of ideological, cultural, religious, racial, and gender biases, and enhancement of the development of desirable values and traits. It also featured sentences that were the right length, used vocabulary appropriate for the reader, had interesting and varied sentence structures, and contained paragraphs that were short but to the point.

Table 6. Level of Validity of the Coursebook along the Factors.

Criteria	Score	Status
Conceptual errors	3.6	Passed
Factual errors	3.7	Passed
Grammatical errors	3.7	Passed
Computational errors	3.8	Passed
Obsolete information	3.4	Passed
Typographical and small flaws (such as confusing or improper graphics, labels missing, captions that are incorrect, etc.)	3.1	Passed
Overall Score	21.3	Passed

Readability Score of the Coursebook

Table 7 reveals that the mean Flesch Reading Ease score for the given material is 66.88, with a descriptor ranking of Standard/Average. This indicates that eighth- and ninth-grade kids can understand the subject matter. The Gunning Fog Index and Smog Index, two indicators, support this conclusion. According to the Coleman Liau Index, Flesch Kincaid Grade Level, and Automated Readability Index, however, pupils in grades six and seven can comprehend the subject. The average material scores for these indicators are 6.15, 6.04, and 7.24, respectively.

Table 7. Readability Score of the Coursebook.

Score	Flesch Reading Ease	Gunning Fog Index	Coleman Liau Index	Flesch Kincaid Grade Level	Automated Readability Index	Smog Index	Description
Chapter 1	64.27	8.89	7.10	7.08	6.50	10.04	8th and 9th
Chapter 2	69.20	8.04	5.32	5.44	6.75	8.77	9th
Chapter 3	61.70	8.47	7.79	6.87	10.50	9.47	6th
Chapter 4	61.32	10.32	7.64	7.08	8.50	10.50	7th
Chapter 5	69.70	8.19	5.88	5.47	6.20	8.89	6th
Chapter 6	75.08	7.20	3.17	4.27	5.00	8.06	6th
Overall (Average)	66.88	8.52	6.15	6.04	7.24	9.29	7th and 9th

Suggestions and Comments on the Coursebook Features

Table 8 presents the suggestions on the coursebook features.

Table 8. Suggestions on the Coursebook.

Coursebook Features	Status
Content	Complied
1. Include an introduction...	
2. Better if example problems are...	
Rubrics	Complied
1. Complete the Indicators/Standards...	
2. Identify a certain percentage...	Partially Complied
3. For criteria of greater weight...	Complied
Exercises	Complied
1. Check the Numbering of exercises...	
2. Improve directions/instruction...	
3. Do not cut questions with...	
4. Test materials should be subjected...	Complied
Margins	Complied
1. On peculiar stat, indicate...	
Presentation and Organization	Complied
1. Screenshots/fig.s must be...	
2. If possible present tables...	
3. An Icon should identify each...	
4. Add related trivia...	
5. Examples may be added before...	
6. The pagination of odd-numbered...	
Format	Complied
1. Back-to-back printing blots...	
Accuracy and Up-to-dateness...	Complied
1. Kindly check if Slovin’s formula...	

Table 9 presents the comments on the coursebook features.

Table 9. Comments on the Coursebook.

No.	Comments
1.	The book is so impressive, very comprehensive, and worthy of reading. How much is your book? Can I have one?
2.	Very nice illustrations and very attractive designs.
3.	The book contains a sufficient amount of practical tasks. It saves time for the teachers to look at and think of a performance task for the students. They are useful in real life.”
4.	Exercises are sufficient to develop students’ understanding of the topics and enhance the critical thinking skills of the students.
5.	It is very good that the source was addressed for the problem that requires data.
6.	The material promotes a love of being Filipino and patriotism of the regional products, events, etc.
7.	The Statistics and Probability book is contextualized in our Region. Congratulations!
8.	Congratulations, you put rubrics in your activities.

Conclusions

The created Coursebook in Probability and Statistics has successfully met all the criteria for approval,

demonstrating its efficacy in supporting the teaching-learning process. With its Very Satisfactory level of validity, the material proves to be appropriate and

effective in enhancing students' understanding of probability and statistics. Moreover, its readability and standard level of difficulty make it suitable for Grade 11 pupils. The Coursebook's development was enriched by valuable input and feedback from expert reviewers, ensuring its quality and relevance. Furthermore, the Coursebook's integration of environmental themes and contexts adds a distinct dimension to its educational value. By contextualizing examples and exercises around the products, culture, events, and environmental issues of the Ilocos Region, the material fosters a deeper connection between students and their local environment. This approach not only enhances their understanding of statistical concepts but also instills a sense of environmental consciousness and stewardship. By incorporating relevant environmental data and analysis, students are encouraged to apply statistical and probabilistic thinking to real-world environmental challenges. The Coursebook's integration of environmental themes enhances its overall impact and aligns with the goal of nurturing "Makakalikasan" learners who are environmentally conscious and equipped to address ecological issues in their communities.

Recommendations

The contextualized and localized Coursebook in Statistics and Probability for Grade XI Senior High School students in the Ilocos Region shows great potential for adoption in schools. Teachers and administrators can benefit from utilizing this Coursebook as it aligns with Filipino and academic values while providing valuable information. However, before recommending the material to students, it should undergo meticulous validation by evaluators to ensure its quality and effectiveness. It is essential to note that the Coursebook was evaluated only once. To enhance its content and ensure content validity, it is highly recommended to conduct further validation. This additional validation process can help identify any areas for improvement and refine the material to better suit the specific needs and preferences of the target audience. To enrich the Coursebook even further, future researchers should

consider incorporating and re-integrating the constructive comments and suggestions provided by the esteemed evaluators. This collaborative effort can enhance the overall quality and relevance of the content, making it more impactful for the students' learning experience. Additionally, future researchers should explore the effectiveness of contextualized and localized instructional materials on students' academic performance.

Conducting a thorough investigation into the impact of such materials can provide valuable insights into their educational value and inform educators on how to maximize their benefits in the classroom setting. By following these recommendations, the Coursebook can become a more robust and effective tool for educators, promoting active engagement in statistics and probability concepts while fostering a sense of cultural and environmental awareness among students in the Ilocos Region.

Implications to Environmental Education and Curriculum Integration

The Coursebook's integration of environmental themes with statistics and probability education presents promising implications for environmental education and curriculum integration in the Ilocos Region and beyond. By engaging students in their local context, promoting critical thinking, and fostering an appreciation for environmental issues, educators can help shape a generation of environmentally responsible individuals who are equipped to address the challenges of biodiversity and environmental sustainability.

The development of the Coursebook in Statistics and Probability contextualized around the environmental conditions, products, culture, events, and issues of the Ilocos Region holds significant implications for environmental education and curriculum integration. By incorporating local context and regional knowledge into the learning materials, this Coursebook offers a unique opportunity to advance biodiversity and environmental sciences among Grade XI students in the Philippines.

Firstly, the Coursebook's contextualized approach allows students to develop a deeper understanding of environmental challenges and biodiversity specific to the Ilocos Region. By using real-world examples and exercises related to their local environment, students can better grasp the relevance and importance of statistics and probability concepts in addressing environmental issues they encounter daily. This not only fosters a stronger connection between students and their local environment but also encourages a sense of responsibility towards its preservation.

Secondly, integrating the Coursebook into the curriculum promotes cross-disciplinary learning and curriculum integration. By infusing statistics and probability concepts with environmental themes, educators can bridge the gap between traditional subjects and environmental education. This holistic approach nurtures critical thinking and problem-solving skills, enabling students to analyze environmental data and make informed decisions on sustainable practices. Moreover, by utilizing the Coursebook as a reference in schools, teachers can effectively engage students in the learning process. The material's appropriate readability level ensures that students from various grade levels can easily comprehend the content, making it accessible to a wide range of learners. This inclusivity in learning approaches encourages active participation and interest in environmental topics, fostering a generation of environmentally conscious citizens. By incorporating environmental themes into statistics and probability education, this Coursebook contributes to a well-rounded and relevant educational experience. It reinforces the importance of incorporating sustainability and ecological awareness into various disciplines, encouraging students to view environmental issues not as isolated problems but as interconnected aspects of their lives and communities.

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