

Development and Pre-Use Evaluation of Instructional Materials in Undergraduate Animal Science Courses for Agriculture Programs

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ABSTRACT In order to facilitate meaningful learning, it is necessary to create and use quality but locally-suited instructional materials in higher education. In this study, three instructional materials (IMs) in Animal Science specialization were made and evaluated following a modified ADDIE model (ADDE). The pre-use evaluation, done by twenty agriculture faculty was conducted using an adopted and validated instrument. Results showed that all features of the three IMs are excellent in all of the criteria (objectives, contents, assessment, and language). The study is important in providing quality IMs for agriculture students, to improve their competencies in animal science courses. It is also beneficial for agriculture faculty since they can use readily-available IMs, and can focus more on mastering other teaching strategies and on performing other functions.

INTRODUCTION

Tertiary educators have three- or four-fold functions, namely instruction, research, extension, and if applicable, production. When it comes to instruction, tertiary educators are not limited to actual classroom teaching, they are expected to plan and design instruction, develop and evaluate instructional materials, and create or discover new knowledge.

In the creation of instructional materials, faculty members can refer to learning theories that can provide the foundation for the selection of instructional strategies and allow for reliable prediction of their effectiveness. There are also instructional design models that can be used, such as the ADDIE (analysis, design, development, implementation and evaluation) model (Khalil and Elkhider 2016).

The research used the ADDIE model in the development of the instructional materials (IMs). The ADDIE model has the following components (Food and Agriculture Organization 2011): 1) Analysis – needs analysis, target audience analysis, task and topic analysis; 2) Design –

learning objectives, sequencing, instructional strategy, delivery strategy, evaluation strategy; 3) Development – content development, storyboard development, courseware development; 4) Implementation – usage and distribution, managing learner’s activities; and 5) Evaluation – reactions, learnings, behavior, results.

In her book “Handbook for Academic Authors”, Beth Luey (2010) asserted that a textbook must be credible and authoritative, which can be achieved by an author who knows the subject thoroughly and can write well. Aside from these, she identified certain pitfalls to avoid in order to maintain credibility. These are exaggeration, obvious bias, and dogmatic and arbitrary statements. She also advised textbook authors to strive for general acceptability, by being fair and avoiding blatant offenses such as stereotyping and ignoring minorities, ridiculing religious or political opinions, or misrepresenting arguments.

Gachukia and Chung (2005) emphasized in their book, “The Textbook Writer’s Manual,” the necessity and beneficiality for textbook writers to: be guided by national educational goals and objectives; promote personal goals; foster national unity; promote sound moral values; provide for acquisition of knowledge, skills and attitudes (KSA) necessary for development; promote social consciousness and responsibility;

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promote international consciousness; instill a culture of hard work; and instill a firm foundation for technological and industrial development.

Although intended for the creation of effective training manual, Lanigan (2010) gave practical advices to make an instructional material more engaging and visually appealing. Gachukia and Chung (2005), and Luey (2010) also gave plenty of information regarding the technicalities of developing textbooks.

For Khodabandeh and Mombini (2018), textbook evaluation is inevitable and necessary in countries where textbooks are considered as the main source of teaching-learning process. In their study, they evaluated an English textbook based on seven criteria: practical considerations, layout and design, activities, skills, language type, subject and content, and cultural considerations. Their findings showed that teachers and students were interested in the book except for cultural considerations.

Similar studies were conducted by Terano (2015a, 2015b, 2018), Abhar (2017), Fatima et al. (2015), and Mohammadi and Abdi (2014). They all studied the pedagogical value and suitability of the textbooks to students' needs. Their results showed general acceptability of the evaluated materials, but were able to emphasize certain shortcomings or problematic areas, and accentuated the need to evaluate textbooks toward continuous improvement of teaching-learning processes. Recent studies on instructional materials (IMs) now center on those IMs that can be used for remote teaching because of the current pandemic on Coronavirus disease 2019 (COVID-19), such as those of Sadler et al. (2020).

In order to facilitate meaningful learning, it is necessary to create and use quality but locally-suited IMs in higher education. Based on these premises, this study focused on the creation and evaluation of IMs on animal science courses for local use in a state college in the Philippines.

Objectives

This study aimed to develop and evaluate instructional materials (IMs) in various animal science subjects that will ultimately be used for instructional purposes. Specifically, the study aimed to develop lecture manual in Animal Pests and Diseases, and laboratory manuals in Poul-

try Production and Animal Nutrition; and conduct evaluation by subject matter experts in terms of objectives, content, organization and usability, assessment, and language used.

METHODOLOGY

Development Phase

This study was a descriptive development research. The research used a modification of the ADDIE model in the development of proposed instructional materials (IMs). The ADDIE model has the following components (Food and Agriculture Organization 2011): 1) Analysis – needs analysis, target audience analysis, task and topic analysis; 2) Design – learning objectives, sequencing, instructional strategy, delivery strategy, evaluation strategy; 3) Development – content development, storyboard development, courseware development; 4) Implementation – usage and distribution, managing learner's activities; and 5) Evaluation – reactions, learnings, behavior, results. The implementation phase was not yet applicable in this study since the IMs were not yet utilized for classroom instruction, and the evaluation phase is limited to pre-use evaluation. The reason for this was that the first batch of new curriculum undergraduate agriculture students will be using the IMs only in future semesters.

The first phase of the study consisted of the 'analysis, design and development' of the three instructional materials (IMs). The analysis part consisted of the needs analysis of the institution, target audience analysis (BSA students and CA faculty), and topic analysis (for the three courses). The design part consisted of designing the learning objectives and sequencing, and the development part was on content development.

Evaluation Phase

Littlejohn (2011) as cited by Khodabandeh and Mobini (2018) argued that by means of materials evaluation, we are able to look inside the materials and take more control over their design and use. The study's second phase was a descriptive evaluation research which was aimed at determining the quality of the instructional materials in animal science courses, as evaluat-

ed by agriculture professors. The evaluation forms based from Khodabandeh and Mobini (2018) and Terano (2015a) were used to assess several evaluation criteria, which included: 1) objectives, 2) content, organization and usability, 3) evaluation (for laboratory manuals only), and 4) language. Validation was done using Lawshe's method, which computes the content validity ratio (Taherdoost 2016), wherein all items got were rated "essential" with a CVR of 1.0 from five expert panel members.

Twenty faculty members from the College of Agriculture served as evaluators of the IMs. Luey (2010) stated that the content reviewers are the author's academic colleagues, and they are asked if the manuscript is accurate and complete, to detect errors, and whether they will use the book in their courses or not. A Likert Scaling Technique was used in the study assessing the quality of the IMs, identifying 5 as the highest (excellent) and 1 as the lowest (poor). The respondents were also told to write freely on the questionnaire and on the IMs, to give comments or suggestions, and to identify observed typographical errors, grammar mistakes, or any other form of inaccuracy or poor presentation. Statistical mean was used to determine the quality of the IMs as perceived by the faculty respondents. The results of evaluation were interpreted using the following scale: 4.50-5.0 – excellent, 3.5-4.49 – good, 2.5-3.49 – average, 1.5-2.49 – fair, and 1.0-1.49 – poor.

RESULTS AND DISCUSSION

Analysis, Design and Development of Instructional Materials

This study was an institutionally-approved research which aimed to create and evaluate three instructional materials. The analysis, design, and development phase, was heavily based on the review of program and course requirements based on the memorandum from the Commission on Higher Education (CHED), and consultation with faculty and students.

According to Nurpamih et al. (2020), need analysis is the starting point in designing a course or developing a material, it is used to gather information from the population about what they need in learning. The analysis part of

this study consisted of the needs analysis of the institution (availability of instructional materials and facilities), target audience analysis (informal interview of BS Agriculture students and faculty regarding their expectations and suggestions for the content and design), and topic analysis (CHED requirements for the three courses, and approved syllabi of different faculty members in the chosen courses/subjects).

The design part consisted of designing the learning objectives and sequencing according to the approved syllabi, guided by the CHED guidelines and institutional format for instructional materials. Also, it included the instructional strategy and delivery methods as prescribed by Gawlik-Kobylnska (2018) and Khalil and Elkhider (2016). Terano (2015b) stated that the design of the educational curriculum in the tertiary level should focus not only on the theoretical aspects but also on the skills which involves activities that will enhance the critical thinking skills of the students.

The development part was on content development using available CHED-recommended references and newly-acquired references by the institution. The topic discussions were made using simpler language to consider the students' level of understanding and other competencies. Development involved several revisions of the draft as influenced by references and informal consultations of other faculty members who are handling the courses. The contents also included self-assessment instrument at the end of the units of the lecture manual, as well as rubrics for assessment of performance in each exercise in the laboratory manuals.

The study's first phase yielded three instructional materials namely: 1) Lecture Manual in Animal Pests and Diseases, 2) Laboratory Manual in Animal Nutrition, and 3) Laboratory Manual in Poultry Production. The course information, lecture or laboratory topics, and intended learning outcomes for these IMs are shown in the Appendix (Tables 1-3).

Five units compose the 'Lecture Manual in Animal Pests and Diseases,' namely: 1) Introduction to Animal Production, 2) Nature of Microorganisms, 3) Nature of Parasites, 4) Diseases of Poultry, and 5) Diseases of Livestock. Each of the units in the manuals follow the same format. In the lecture manual, the order of present-

Table 1: Evaluation results of the lecture manual in animal pests and diseases

<i>Indicators</i>	<i>Mean</i>	<i>Verbal description</i>
<i>Objectives</i>	<i>4.81</i>	<i>Excellent</i>
1. The objectives are specific and clearly stated.	4.85	Excellent
2. The objectives are attainable and measurable.	4.73	Excellent
3. The objectives are suitable to the topic.	4.80	Excellent
4. The objectives promote critical thinking and creativity.	4.85	Excellent
<i>Content, Organization and Usability</i>	<i>4.69</i>	<i>Excellent</i>
1. The topics are organized effectively.	4.63	Excellent
2. The length of the discussion is appropriate.	4.63	Excellent
3. The content is current, relevant and accurate.	4.70	Excellent
4. The contents are organized effectively into learning units, from simpler to complex.	4.63	Excellent
5. There is clear presentation of the discussions.	4.74	Excellent
6. The contents are suitable to the learning ability of the students.	4.74	Excellent
7. The lecture manual is useful to the teacher and student for it provides adequate information on the course/subject.	4.80	Excellent
<i>Language</i>	<i>4.71</i>	<i>Excellent</i>
1. There is no grammatical or spelling error within the texts of the manual.	4.85	Excellent
2. The language used is at the right level for the students.	4.73	Excellent
3. There is no exaggeration, obvious bias, dogmatic or arbitrary statements.	4.80	Excellent
4. There is no sexist or racist language, and do not portray any negative stereotypes.	4.85	Excellent
Grand Mean	4.73	Excellent

Table 2: Evaluation results of the laboratory manual in animal nutrition

<i>Indicators</i>	<i>Mean</i>	<i>Verbal description</i>
<i>Objectives</i>	<i>4.79</i>	<i>Excellent</i>
1. The objectives are specific and clearly stated.	4.90	Excellent
2. The objectives are attainable and measurable.	4.80	Excellent
3. The objectives cater to the needs of the learners.	4.70	Excellent
4. The objectives develop critical thinking and creativity.	4.75	Excellent
<i>Content, Organization and Usability</i>	<i>4.71</i>	<i>Excellent</i>
1. The introductory statements provide bird's eye view of the concept/theory presented.	4.70	Excellent
2. The content and procedure in each activity/experiment are clear, simple and accurate.	4.70	Excellent
3. The contents are adequate to the requirements of the objectives defined.	4.75	Excellent
4. The content facilitates understanding and retention of information.	4.75	Excellent
5. The sequence of instructions is appropriate and easy to follow.	4.75	Excellent
6. The activities promote balance, collaboration and interaction among learners.	4.70	Excellent
7. The approaches can stimulate students' interest and draw on precise conclusions based on their observations.	4.65	Excellent
8. The method can facilitate learning process.	4.70	Excellent
<i>Evaluation</i>	<i>4.75</i>	<i>Excellent</i>
1. The evaluation report sheet is well formatted and appropriate.	4.75	Excellent
2. The post-lab questions measure the attainment of objectives.	4.65	Excellent
3. The evaluation questions are clear to the students.	4.85	Excellent
4. The evaluation includes questions to stir critical thinking.	4.65	Excellent
<i>Language</i>	<i>4.78</i>	<i>Excellent</i>
1. The language used is appropriate and easy to understand.	4.75	Excellent
2. The vocabulary word used is within the context of the discipline.	4.85	Excellent
3. The language used is free of any discrimination.	4.85	Excellent
4. There is no grammatical or spelling error within the texts of the manual.	4.65	Excellent
Grand Mean	4.75	Excellent

Table 3: Evaluation results of the laboratory manual in poultry production

<i>Indicators</i>	<i>Mean</i>	<i>Verbal description</i>
<i>Objectives</i>	4.78	Excellent
1. The objectives are specific and clearly stated.	4.80	Excellent
2. The objectives are attainable and measurable.	4.85	Excellent
3. The objectives cater to the needs of the learners.	4.65	Excellent
4. The objectives develop critical thinking and creativity.	4.80	Excellent
<i>Content, Organization and Usability</i>	4.65	Excellent
1. The introductory statements provide bird's eye view of the concept/theory presented.	4.60	Excellent
2. The content and procedure in each activity/experiment are clear, simple and accurate.	4.55	Excellent
3. The contents are adequate to the requirements of the objectives defined.	4.75	Excellent
4. The content facilitates understanding and retention of information.	4.75	Excellent
5. The sequence of instructions is appropriate and easy to follow.	4.65	Excellent
6. The activities promote balance, collaboration and interaction among learners.	4.50	Excellent
7. The approaches can stimulate students' interest and draw on precise conclusions based on their observations.	4.70	Excellent
8. The method can facilitate learning process.	4.70	Excellent
<i>Evaluation</i>	4.53	Excellent
1. The evaluation report sheet is well formatted and appropriate.	4.25	Good
2. The post-lab questions measure the attainment of objectives.	4.60	Excellent
3. The evaluation questions are clear to the students.	4.55	Excellent
4. The evaluation includes questions to stir critical thinking.	4.70	Excellent
<i>Language</i>	4.76	Excellent
1. The language used is appropriate and easy to understand.	4.70	Excellent
2. The vocabulary word used is within the context of the discipline.	4.80	Excellent
3. The language used is free of any discrimination.	4.80	Excellent
4. There is no grammatical or spelling error within the texts of the manual.	4.75	Excellent
Grand Mean	4.67	Excellent

tation is as follows: 1) Unit Number and Title, 2) Objectives, 3) Lesson Number and Title, 4) Discussion, 5) Self-Assessment.

Each of the laboratory exercises in the manuals follow the same format: 1) Student Profile (Name, Course and Year), Date and Score; 2) Laboratory Exercise and Number and Title, 3) Introduction, 4) Objectives, 5) Methodology, and 6) Evaluation Report Sheet. In the 'Laboratory Manual for Animal Nutrition,' there are 10 laboratory exercises: 1) Digestive System Farm Animals, 2) Identification of Feed Ingredients, 3) Identification of Forages, 4) Anti-Nutrition Factors and Toxic Metabolites, 5) Feed Analysis, 6) As-Fed and As-Dry Matter Basis Interconversion, 7) Ration Formulation Using Pearson Square Method, 8) Ration Formulation Using Trial-and-Error Method, 9) Silage Making, and 10) UMMB (Urea-Molasses-Mineral Block) Preparation.

The 'Laboratory Manual for Poultry Production' has 12 laboratory exercises. These are: 1) Poultry Breeds and Strains Characterization, 2)

Anatomy of the Chicken, 3) Male and Female Reproductive System, 4) Eggs, 5) Poultry Housing and Equipment, 6) Hatchery Operations, Candling and Sexing, 7) Calculation of Parameters in Broiler Performance, 8) Calculation of Parameters in Layer Performance, 9) Poultry Restraint, Blood Collection and Vaccine or Drug Administration, 10) Examination and Necropsy of Poultry, 11) Culling and Selection, and 12) Dressing and Processing of Poultry.

Evaluation of Lecture Manual in Animal Pests and Diseases

Table 1 presents the evaluation results on the Lecture Manual in Animal Pests and Diseases. In terms of objectives, the faculty evaluators gave 4.85 mean rating for the objectives being 'specific and clearly stated,' 4.73 for being 'attainable and measurable,' 4.80 for being 'suitable to the topic', and 4.85 for being able to 'promote critical thinking and creativity.' With a composite mean of 4.81, the objectives of the lecture

manual were thus rated as excellent. The author used Bloom's taxonomy in the formulation of objectives for the IMs. Adams (2015) emphasized that Bloom's taxonomy is valuable in the writing of learning objectives, and in classifying them as to the learning domain, and complexity and specificity.

The content, organization and usability of the lecture manual, as also shown in Table 1 were also adjudged as excellent for having a composite mean of 4.69. The highest mean obtained was in the indicator "The lecture manual is useful to the teacher and student..." while the lowest mean is still high at 4.63 for three indicators on pertaining to the organization of the manual. The contents of the manual are based on the syllabus approved by the institution for the Bachelor of Science in Agriculture curriculum, which followed the standards and guidelines set by the Commission on Higher Education of the Philippines (CHED). Gachukia and Chung (2005) stated that the textbook writer should be guided by the specific objectives stated in the syllabus at each level and more specifically in each topic. They also held that the information in the text should flow like oil in an engine for maximum readability. In her study, Ramirez (2016) explained that high rating on the content of her developed instructional material indicated that the concepts presented were enough for the learners to acquire the necessary competencies on the topics, and that it implied the experts noted the completeness, correctness, suitability and clarity of presentation of concepts in most of the lessons.

The language used in the manual is also excellent as shown by the mean rating of 4.71. A mean of 4.85 was obtained in the indicators "no grammatical or spelling error" and "no sexist or racist language and do not portray any negative stereotype." Luey (2010) detailed on the threats to credibility which may be due to faulty language used in a textbook, and these were used as guide by the author in stating the indicators in the survey form. Gachukia and Chung (2005) also asserted that textbook writers need to ensure correct use of language in all its forms. The grand mean obtained for the 'Lecture Manual in Animal Pests and Diseases' was 4.73, implying that the faculty evaluators were satisfied with the objectives, contents, organization, usability, and language in the manual.

Evaluation of Laboratory Manual in Animal Nutrition

Table 2 presents the evaluation results in the 'Laboratory Manual in Animal Nutrition' which obtained a grand mean of 4.75, with a verbal description of excellent. In terms of objectives, the indicators had a composite mean of 4.79 with a verbal description of excellent. The highest mean of 4.90 was for "the objectives are specific and clearly stated," and the lowest of 4.70 was for the "objectives cater to the needs of the learners." These results imply that the evaluators are favorable to the manual. The author is also encouraged, since learning objectives are important in the quality evaluation of an IM, and these objectives can guide teachers if the IM is suitable for their students (Hartley 2013; Terano 2015a).

With regards to the content, organization and usability of the manual, an excellent composite mean of 4.71 was likewise obtained. The eight indicators in this category had a range of 4.65 to 4.75, all having a verbal description of excellent. These results imply that the contents of the manual are highly acceptable to the faculty evaluators, and they find it suitable to the students of the institution. Suitability, according to Reiser and Dempsey (2012) as cited by Terano (2015a), can be achieved when instructional materials' contents are student-centered and goal-oriented.

In terms of evaluation and language, the manual also obtained excellent from both categories, with ratings of 4.75 and 4.78, respectively. Each of these categories had four indicators, whose ratings ranged from 4.65 to 4.85. Dick et al. (2014) as cited by Terano (2015a) argued that assessment must be parallel to and able to measure the learners' ability to perform what is described in the objectives. Gachukia and Chung (2005) highlighted language as a critical medium of learning and of textbooks, and that textbook writers must use generally-accepted, standard and correct language.

Evaluation of Laboratory Manual in Poultry Production

The evaluation results for the 'Laboratory Manual in Poultry Production' are shown in Ta-

ble 3. The manual had a grand mean of 4.67 or excellent. Among the evaluation categories, the objectives, having a range of 4.65 to 4.85 in the four indicators, had the highest composite mean of 4.78. According to Tomlinson (2011) as cited by Khodabandeh and Mombini (2018), evaluation is the systematic appraisal of the value of materials in relation to their objectives and to the objectives of the learners using them. The results imply that the faculty evaluators give high appraisal to the objectives of this instructional material.

The content, organization and usability of the manual had an excellent composite mean of 4.65 as also shown in Table 3. The eight indicators in this category had a range of 4.50 to 4.75. They also conform to Resier and Dempsey (2012) as cited by Terano (2018). In terms of evaluation, the manual got a 4.53 composite mean, having a range of 4.25 to 4.70 in the four indicators. These results imply that this laboratory manual also conform to Dick et al. (2014) as cited by Terano (2015a), regarding having evaluation which is parallel to the objectives of the learning materials. In the language category, an excellent mean of 4.76 was likewise attained, with 4.70 to 4.80 range in four indicators. This implies that the manual also complies with the use of appropriate language according to Gachukia and Chung (2005). All of these results imply that this Laboratory Manual in Poultry Production is acceptable to the evaluators.

CONCLUSION

Three instructional materials (IMs) in animal science were developed, namely Lecture Manual in Animal Pests and Diseases, Laboratory Manual in Animal Nutrition, and Laboratory Manual in Poultry Production. Pre-use evaluation by experts which were twenty Agriculture faculty yielded a grand mean of 4.73, 4.75 and 4.67, respectively, for the three manuals. Based on these results, it can be concluded that the IMs were of excellent quality in terms of objectives, content, organization and usability, evaluation, and language. These imply that the evaluators perceive the IMs to be effective for the Agriculture students of the state college.

RECOMMENDATIONS

The Instructional Materials may be evaluated during and after use by its users, including students and faculty, in the future semesters. Periodic revision can be done to update the IMs based on recent research results made by the faculty in the institution, or other published researches and books of reputable publishers. With the new normal, the instructional materials may be converted to electronic form and also be evaluated by faculty and student users.

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APPENDIX

Portions of the Course Syllabi of the three IMs Developed

Table 1: Course information, lecture topics and intended learning outcomes for the Lecture Manual in Pests and Diseases of Farm Animals

Course Name: Pests and Diseases of Farm Animals

Course Description: Biology, mechanics of transmission, control and prevention of agents of diseases of farm animals

Course Objectives: At the end of the course, students are expected to be able to:

1. Describe the different microorganisms and parasites that cause diseases in farm animals;
2. Identify the diseases that affect the different body systems of farm animals; and
3. Explain the control and preventive measures for farm animals' diseases.

<i>Lecture Topics</i>	<i>Intended Learning Outcomes</i>
<p><i>I. Introduction to Animal Health Management</i></p> <p>A. Types of pests and diseases in farm animals</p> <p>B. History of animal production and health management</p> <p>C. Factors affecting animal health and disease</p> <p>D. Principles of Disease Prevention and Biosecurity</p>	<ol style="list-style-type: none"> 1. Define health, disease and other related terms on animal health; 2. Identify the different types/methods of transmission, infection and disease; 3. Expound how different agent, host and environment factors bring about health/disease states, and how they interact with one another; 4. Discuss biosecurity procedures and their importance.
<p><i>II. Nature of Microorganisms and Pathogenesis of Microbial Diseases</i></p> <p>A. Short history of microbiology</p> <p>B. Bacteria</p> <p>C. Viruses</p> <p>D. Fungi</p> <p>E. Transmission and pathogenesis of microbial diseases</p>	<ol style="list-style-type: none"> 1. Define terms used in microbiology; 2. Identify the microbiologists who have contributed to the growth of microbiology as a science; 3. Discuss the properties of microorganisms; 4. Describe how microorganisms cause disease.
<p><i>III. Nature of Parasites and Pathogenesis of Parasitic Diseases</i></p> <p>A. Arthropods</p> <p>B. Helminths</p> <p>C. Protozoa</p> <p>D. Transmission and pathogenesis of parasitic diseases</p>	<ol style="list-style-type: none"> 1. Define the different terminologies used in arthropology, helminthology and protozoology; 2. Classify the different parasites affecting animals based on their structure and life cycle; and 3. Discuss the development of parasitic diseases.
<p><i>IV. Poultry Diseases</i></p> <p>A. Bacterial and Fungal Diseases</p> <p>B. Viral Diseases</p> <p>C. External Parasitic Diseases</p> <p>D. Internal Parasitic Diseases</p> <p>E. Nutritional Disorders</p> <p>F. Other Diseases/Disorders</p>	<ol style="list-style-type: none"> 1. Identify the etiology of the different poultry diseases; 2. Describe the clinical picture of diseases in affected poultry species; and 3. Explain the preventive and control measures of poultry diseases.
<p><i>V. Livestock Diseases</i></p> <p>A. Bacterial and Fungal Diseases</p> <p>B. Viral Diseases</p> <p>C. External Parasitic Diseases</p> <p>D. Internal Parasitic Diseases</p> <p>E. Nutritional Disorders</p> <p>F. Other Diseases/Disorders</p>	<ol style="list-style-type: none"> 1. Identify the etiology of the different livestock diseases; 2. Describe the clinical picture of diseases in affected livestock species; and 3. Explain the preventive and control measures of livestock diseases.

Table 2: Course information, laboratory topics and intended learning outcomes for the Laboratory Manual in Animal Nutrition

<i>Course Name:</i> Animal Nutrition	
<i>Course Description:</i> Composition and use of feeds, formulation of rations, and feeding practices for livestock and poultry	
<i>Course Objectives:</i> At the end of the course, students are expected to be able to:	
<ol style="list-style-type: none"> 1. Identify basic components of animal diet; 2. Discuss the use and function of feeds by farm animals; 3. Formulate or compound rations to meet nutritional needs; and 4. Apply appropriate and sound management practices. 	
<i>Laboratory Topics</i>	<i>Intended Learning Outcomes</i>
<i>Digestive System of Farm Animals</i>	<p>At the end of this chapter, the student should be able to:</p> <p>At the end of this exercise, the students are expected to be able to:</p> <ol style="list-style-type: none"> 1. Identify the parts of the digestive system of non-ruminants; 2. Describe the organs and explain their functions; 3. Discuss the processes of digestion, absorption and metabolism of non-ruminants animals; and 4. Differentiate the digestive systems of ruminants, pseudoruminants and avians in terms of structure and function.
<i>Identification of Feed Ingredients</i>	<ol style="list-style-type: none"> 1. Identify common feed ingredients; and 2. Indicate the nutrient composition of common feed ingredients, specially the energy (ME, DE) and crude protein contents;
<i>Identification of Forages</i>	<ol style="list-style-type: none"> 1. Distinguish common grasses and legume; and 2. Identify the common name and scientific name of grasses and legumes.
<i>Anti-Nutrition Factors and Toxic Metabolites</i>	<ol style="list-style-type: none"> 1. Identify common anti-nutrition factors, their feed sources and effects to animals; and 2. Discuss methods and ways on how anti-nutrition factors are avoided or prevented from exerting their effects on farm animals.
<i>Silage Making</i>	<ol style="list-style-type: none"> 1. Explain the importance of feed preservation; 2. Identify the materials needed in silage making; 3. Discuss the steps in silage making; 4. Prepare a silage and report observations on the finished product after the fermentation period; and 5. Elucidate the precautionary measures to be observed in silage making.
<i>Urea-Molasses-Mineral Block (UMMB) Preparation</i>	<ol style="list-style-type: none"> 1. Explain the importance of supplementation in ruminants; 2. Identify the materials needed in UMMB making; 3. Discuss the steps in UMMB making; 4. Prepare a UMMB and make a narrative report; and 5. Elucidate the precautionary measures to be observed in UMMB making.
<i>Ration Formulation Using Pearson Square Method</i>	<ol style="list-style-type: none"> 1. Discuss the steps in using the Pearson square method of feed formulation; 2. Compute for the amount of feed ingredients to be included in the ration based on a given requirement and list of ingredients; and 3. Formulate a ration for a specific animal appropriate for its age/stage of growth.
<i>Ration Formulation Using Trial-and-Error Method</i>	<ol style="list-style-type: none"> 1. Discuss the steps in using the trial-and-error method of feed formulation; 2. Compute for the amount of feed ingredients to be included in the ration based on a given requirement and list of ingredients; and 3. Formulate a ration for a specific animal appropriate for its age/stage of growth using this method and compute for the cost.
<i>Feed Analysis</i>	<ol style="list-style-type: none"> 1. Discuss how feed nutrients are determined; 2. Indicate the tests, reagents and apparatuses used in determining such nutrients; 3. Differentiate digestion trial, balance trial and feeding experiments; and 4. Discuss how digestibility trials are carried out in farm animals.
<i>As-Fed and As-Dry Matter Basis Interconversion</i>	<ol style="list-style-type: none"> 1. Differentiate the methods of expressing nutrient content of feeds; 2. Compute for the nutritional values from an as-fed basis to dry matter basis, and vice versa; 3. Convert one unit of measure to another.

Table 3: Course information, laboratory topics and intended learning outcomes for the Laboratory Manual in Poultry Production

<i>Course Name: Poultry Production</i>	
<i>Course Description: Production and management systems for different poultry species particularly chicken and duck (meat and egg types)</i>	
<i>Course Objectives: At the end of the course, students are expected to be able to:</i>	
	<ol style="list-style-type: none"> 1. Distinguish the different types, classes, breeds and strains of poultry species; 2. Discuss the production processes for the different growth stages; 3. Explain the control and preventive measures for poultry diseases; and 4. Perform basic farm operations on poultry production and processing.
<i>Laboratory Topics</i>	<i>Intended Learning Outcomes</i>
<i>Poultry Breeds and Strains Characterization</i>	<ol style="list-style-type: none"> 1. Identify the different types and breeds of chicken. 2. Distinguish the different breeds based on their physical traits.
<i>Anatomy of the Chicken</i>	<ol style="list-style-type: none"> 1. Compare and contrast the physiological processes between mammals and birds; 2. Explain the functions of different body systems in chickens; and 3. Identify the different organs of chicken, their parts and functions.
<i>Male and Female Reproductive System</i>	<ol style="list-style-type: none"> 1. Identify the parts of the male and female reproductive system; 2. Discuss the functions of the reproductive organs.
<i>Eggs</i> 1.	<ol style="list-style-type: none"> 1. Identify the parts of an egg. 2. Determine the quality and desirability of eggs. 3. Determine the freshness of eggs.
<i>Silage Making</i>	<ol style="list-style-type: none"> 1. Explain the importance of feed preservation; 2. Identify the materials needed in silage making; 3. Discuss the steps in silage making; 4. Prepare a silage and report observations on the finished product after the fermentation period; and 5. Elucidate the precautionary measures to be observed in silage making.
<i>Hatchery Operatin, Candling, and Sexing</i>	<ol style="list-style-type: none"> 1. Perform egg candling. 2. Perform sexing of straight-run chicks. 3. Discuss the different types of hatcheries. 4. Distinguish healthy and abnormal chicks.
<i>Poultry Housing and Equipment</i>	<ol style="list-style-type: none"> 1. Design poultry housing and equipment. 2. Indicate the floor and feed space requirements using different water and feed troughs and trays.
<i>Calculation of Parameters, Broiler Performances</i>	<ol style="list-style-type: none"> 1. Perform proper calculations on broiler performances. 2. Discuss the formula and/or importance of the different performance indicators.
<i>Calculation of Parameters, Layer Performances</i>	<ol style="list-style-type: none"> 1. Perform proper calculations on layer performances 2. Discuss the formula and/or importance of the different performance indicators.
<i>Culling and Selection</i>	<ol style="list-style-type: none"> 1. Differentiate productive and non-productive layers for either culling or selection. 2. Perform culling and selection in layers.
<i>Dressing and Processing of Poultry</i>	<ol style="list-style-type: none"> 1. Perform dressing of poultry. 2. Discuss the different procedures in processing poultry meat.
<i>Poultry Restraint, Blood Collection, and Vaccine or Drug Administration</i>	<ol style="list-style-type: none"> 1. Handle poultry correctly, and to restraint them for inspection and drug/vaccine administration. 2. Indicate the sites for collection of blood from poultry. 3. Discuss the recommended vaccination program of poultry for proper health management of poultry
<i>Examination and Necropsy of Poultry</i>	<ol style="list-style-type: none"> 1. Explain the importance of poultry disease diagnosis. 2. Perform necropsy in a poultry specimen. 3. Accomplish records in a necropsy procedure.