

## Development of Professional Skills through Subject Animal Anatomophysiology

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Citación: Sónora Revoredo, H., Guzmán Méndez, R., Godinez Do – Val, A., Simón Foustén, M., & Castro Torres, B. (2019). Development of Professional Skills through Subject Animal Anatomophysiology. *Agrisost*, 25(3), 1-9. Recuperado a partir de <https://revistas.reduc.edu.cu/index.php/agrisost/article/view/e3346>

Received: July 16, 2019

Accepted: November 17, 2019

Published: December 3, 2019

Funding source: undeclared.

Conflicts of interest: no conflict of interest has been declared.

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### Abstract

**Context:** One of the most important problems of pedagogical work in higher education is the process of professional skills training, which is part of professional education, in which scientific information should be applied in a creative manner to provide solutions to the problems of society.

**Aim:** To contribute to the development of professional skills through subject Animal Anatomophysiology.

**Methods:** Theoretical and empirical research methods were used, which demonstrated the insufficient development of professional skills in subject Animal Anatomophysiology, in students of the Agricultural Education Degree.

**Results:** A methodological guide that allows students to systematize professional skills through subject Animal Anatomophysiology is provided.

**Conclusions:** This methodological guide is a way to develop professional skills through subject Animal Anatomophysiology in students of the Agricultural Education Degree, based on the implementation of concrete actions in a flexible manner, and using several different levels of complexity.

**Key words:** professional skills, animal anatomy, animal physiology.

### Introduction

The optimization of the main work objectives of academic courses has a decisive influence on quality professional preparation in education, in general, and particularly, the students of Agricultural Education.

Subject Animal Anatomophysiology is part of the Biological Sciences Discipline. The objective of the subject is to explain physiological processes inherent to animals, according to relations: structure - function of organs [...], through the application of scientific research methods, and information technologies [...] (MES, 2016).

In order for student to graduate from universities, especially pedagogical students, in compliance with the demands of the Cuban society, and be able to deal with their professional careers as teachers, efficiently,

it is important to develop the professional skills below: To describe, characterize, identify, classify, and relate structure with function of different bones in the skeleton.

This is a critical element, and to achieve that goal, initiative, creativity, and constant encouragement are necessary, as shown in a study done by several authors, including Montes de Oca & Machado (2009); Salellas (2014), Guzmán (2014), Quesada, Leyva & Mechero (2016), Estrada, Parrado & Chío (2016), Pérez (2017).

Today, the development of science and technology has produced such an amount of information that higher education teachers are expected to increase the quality of teaching, in order to ensure effective student learning. This rationale contributes to greater transformation and application of scientific

knowledge quickly. Moreover, the curricula should not grow further in years and number of hours. In face of that contradiction, educators are expected to determine manners to develop capacities, skills, and habits in future professionals, so they are ready to assimilate scientific and technical information, and apply it creatively.

This shows how important it is to meet that purpose, though this task is painstaking for teachers and professors. Undoubtedly, teaching how to do things, and prepare man for life, is a pressing need in times of fast-paced scientific and technical development.

In the experimental phase of this research, the authors were able to corroborate the existence of some irregularities in subject Animal Anatomophysiology that interfere in the performance of professional skills in students, such as,

The short number of tasks, and their orientation, seeking development of professional skills.

Insufficient knowledge of students, observed in responses with low levels in relation to the structure-function of bones.

In that sense, this paper intends to show a way to develop professional skills in subject Animal Anatomophysiology.

## Materials and Methods

The methods used to develop this study were determined by the aim of this research. The theoretical methods used were analysis and synthesis, induction-deduction, and historical logical, which offered a theoretical systematization that contributes to the understanding of the chronological process of skill training throughout history.

The empirical methods used were document review, survey, and interview to experienced professionals, to assess the information collected from relevant sources: the literature reviewed, and the opinions provided in the inquiry to experienced teachers engaged in skill formation. System approach was a necessary condition in the development of this research, which facilitated the orientation and direction of this work.

## Results and discussion

Several opinions were analyzed to classify skills as general, specific, work, teaching, and professional (H. Brito & González, 1987); and intellectual, practical, and teaching skills (Barrera, 2003), just to mention a few of them. The authors coincide with the opinion of Rita M. Álvarez de Zayas (1990), who recognizes the skills of thinking, information processing, communication, and the professional skills, which are the core of this study.

Assuming the definition provided by González Abreu (2004), professional skills are "... actions that express

the mastery of part of an activity related to the practice of the profession or trade in which the subject will interact, considering the conditions for implementation, and the degree or level of knowledge" (p.6).

Analysis of skills to be dealt with in the systematizing proposal

Analysis of skills to be developed in students through subject Animal Anatomophysiology, based on this proposal.

To describe: In this skill, the characteristics or elements observed in the object of description, that is, verbalization of what is perceived, are listed and related. (Barreras, 2006)

This skill allows students to describe bones graphically, or by means of verbal or written language, with sufficient details to enable characterization for accurate determination of bones. Hence, it is important to determine and observe the object of description (bones), set a plan for description, and arrange it logically, to establish the relation of essential elements, and finally, to reproduce the characteristics of the object (bone), according to the previously set plan.

To characterize: In this skill, a comparison is made with other objects in the same or other classes, to choose the elements that typify and distinguish them. (Barreras, 2006)

In it, objects or phenomena are analyzed by determining their essential part for comparison with others within their class or other classes. Therefore, the elements that typify and distinguish the bone from other bones in the skeleton are chosen.

To identify: A skill through which the traits that characterize an object or phenomenon are determined. Accordingly, their pertinence to the extension of a concept or law is unveiled. (Barreras, 2006)

The characteristic of this skill is to determine that two or more things look alike, and therefore, are considered as one. It recognizes if the object is the one sought for, as belonging to the object of reference. Bone identification is established through the corroboration of essential traits and characteristics of the bone.

To classify: A distribution of objects or individual phenomena in their corresponding genera or class; it deals with the presentation of characteristics, links, and essential and general relations of objects and phenomena, based on a criteria adopted for classification. (Barreras, 2006)

Hence, the classification of different bones of the skeleton requires the consideration of their shape (length, width, and thickness), and function (locomotion, support, and protection), thus

determining the classification of the bone. Accordingly, abstraction, comparison, and analysis of several different bones are expected.

To relate: A skill through which the links of determination, dependency, consistence or opposition between or among objects, phenomena or processes, are unveiled. (Barreras, 2006)

In this skill, the individual is expected to analyze bones independently, determine the relation criteria between the shape and function of bones, and come to conclusions.

Why is this a systematizing proposal?

In relation to difficulties observed in Agricultural Education students at the Ignacio Agramonte University of Camagüey, it was important to promote the development of professional skills based on the implementation of a systematizing proposal, which helps increase the level of student professional performance.

In that sense, Peña, Breijo & López (2016) said that in the concept of skill, three essential properties are distinguished: systematization of actions made by individuals; actions subordinated to a goal; and non-automated, conscious actions.

Likewise, Martínez, Morell & Escudero (2019), noted that skills come from the systematization of subordinated actions to pursue a conscious goal.

Why is it a systematizing proposal?

In the context of Technical and Professional Education in Agriculture, and according to its social object, several professional skills should be developed, since they are the base for performance. Hence, process systematization is important, through the integration of theory and practice, the preparation of theoretical contents, and their practical mastery. It assumes the possibility of using different knowledge in practice, according to the goal or target set.

What can be taught and learned through the systematizing proposal?

This proposal clearly states what will be studied; in other words, the contents of a particular unit: to describe, characterize, identify, classify, and relate. However, this may be generalized in order to develop other skills.

How can the systematizing proposal be used to teach and learn?

The systematizing proposal shapes the way a teacher will run the development of professional skills, and how students are to build their own mode of performance. It offers a pathway to achieve the set goal.

In that regard, Rodríguez (2012), in his PhD thesis refers to the close relation between professional skills and knowledge. He explains how knowledge is

systematized along with skills. Therefore, higher knowledge can be acquired through the systematization of professional skills, not losing the perspective that knowledge prevails over skills.

Basic professional skills in the context of technical and professional education can be developed, providing that the aim of the lesson is stated as a concrete action, and if the educator works on the systematic achievement of such aim. Hence, a concrete action can be implemented as stated by the aim, flexibly, and with different degrees of complexity.

Talízina (1988) noted that the individuals that will master the skill, the aim achieved through the skill, the orientation that determines the structure of such action, and the expected outcome of the action (which must coincide with the aim), should be taken into consideration when characterizing skills, based on the elements and set of operations that form their technical structure.

The process of formation and development of professional skills demands voluntary and conscious attention, real assimilation of the system of actions that integrate them, and the knowledge to which they are associated. Therefore, it requires understanding of the meaning and value of the process of knowing. Accordingly, TPE (technical and professional education) teachers, particularly in the specialty of Agriculture Education, should not only master the terms of the theory of the system of knowledge of the most diverse subjects they deliver, but also consider the challenge posed by the advancement of science itself from a perspective of knowing how through teaching how than by transmitting information.

Considering the previously referred aspects, to acknowledge the presence of a skill, during the implementation of actions, some degree of systematization must be accomplished so it leads to mastery of the system of essential, necessary, and indispensable operations to carry it out. That is precisely the aim of the authors of the proposal.

To achieve effectiveness in skill formation, it is important to manage a proper order of steps to follow in the pedagogical scenario, so that the action becomes a skill under specific conditions, which will depend on the quality of actions, knowledge, and skills developed. Telling the aims to students is essential, so that this action enables the materialization of the type of actions, though their theoretical or practical contents and the conditions change.

There must be a certainty that the learning process will be active and conscious in order for students to acquire knowledge, methods, and procedures without difficulties, which can be implemented to solve professional problems.

Skill formation is known as the stage comprising conscious acquisition of performance modes, when under the guidance of teachers, students are oriented on how to learn, precisely when the Action Orienting Base (AOB) takes a relevant place. Besides, it is important to point out that when students have acquired new modes of performance, they must move on to skill implementation.

The action orienting base suggested in this paper consists of thorough orientation that students receive to be able to find solutions on their own, based on timely implementation of a general method or procedure (Action Orienting Base III). To make it comprehensive, it must have a motive, objective, content, process, conditions, assessment, and control.

Methodologically, it is important to make differences since early stages. However, in teaching practice they are complemented and interdependent.

Teachers should assist students in the acquisition of new knowledge; students should conjugate the new knowledge with the already learned contents, in order to implement the steps of learning new skills.

An important skill development and formation element is that educators present the new skill and its internal structure. In other words, the sequence of actions, so it becomes a skill. Students should do it systematically, continuously, and consciously. These elements are important, since they allow students to correct their mistakes, and realize that the same type of skill can be developed through different knowledge systems.

For a student to acquire a new skill, subjects should present a system of skills made by actions, which are functional invariants of each skill, not actions or situational, casuistic, and non-essential instruments. Accordingly, the systematization of these invariants permits the mastery of a skill. Therefore, proper treatment of action frequency and periodicity, which are the quantitative requisites, is required, as well as the degree of difficulty and variability, as qualitative requisites, with which action and operation work.

The authors of this paper suggest that to achieve adequate skill development, teachers should,

- Have mastery of the contents of the subject taught.
- Master the structure of the skill to be developed.
- Have a clear idea of the methodology to follow for skill development.
- Conduct a systematic and conscious study aimed to practice the skill to be developed until total mastery.
- Be ready to acknowledge mistakes and correct them.

As stated in the Model of the Professional (2016), so that students from the Degree of Agricultural Education acquire proper assimilation of knowledge, it is important to develop theoretical and practical (agriculture) skills through the different subjects that make up the curriculum of the degree. Hence, students must solve technical and/or pedagogical problems of Technical and Professional Education, using scientific research methods, with confidence, hard work, flexibility, and independence to train technically skilled labor, based on the scientific principles and skills that govern the rearing of domestic species, in terms of health and economic efficiency, considering the environmental dimension with creativity, and encouraging love for work, job discipline, and ethical and aesthetic values based on the ideology of the Cuban revolution. Then, students will be expected to describe, characterize, identify, classify, relate, and so on. Hence, in the teaching-learning process, systematizing proposals should be embraced in order to form the above-mentioned skills.

The objectives, as a governing category of the educational process, play a key role in determining the skills to be developed by students through subjects. In the Model of the Professional, the general and year objectives are presented, which students must overcome. In the second year of the specialty, the third objective is stated as follows, To relate a structure to the function of different organs and systems of species with the highest zoo-technical interest, in concert with the environment. If expressed as a skill, this objective permits suggesting other skills for this particular subject, such as describing, characterizing, identifying, classifying, and relating.

The systematizing proposal includes these steps:

- To present the task to be developed. System of knowledge and properly oriented bibliography.
- To present the skills with their system of actions.

The systematizing proposal is shown as an example in relation to Topic I of subject Animal Anatomophysiology, particularly to osteology contents.

Topic I: Osteology. Arthrology. Myology.

Objective: To relate the structure to function that is manifested in the bone system.

Orienting Lecture No. 1.

- I) Summary: Bone tissue: structures: functions.
- II) Questions to be answered in the next practical lesson: Can you relate structure and function manifested in the bone system?

III) Assign the homework, system of knowledge of homework, and the corresponding bibliography.

Task No. 1. To describe the bone tissue.

Bone structure. Chemical composition of bones. Physical properties of bones.

Bibliography

Anatomy of domestic animals. pp. 6 – 10.

Veterinary physiology. Book 2. pp. 909 – 912.

Task No. 2. To characterize the bone system

Periosteum. Endosteum. Haversian canals. Bone marrow: functions.

Bibliography

Anatomy of domestic animals. pp. 6 – 10.

Veterinary physiology. Book 1. pp. 473 – 474, and Book 2. pp. 909 – 912.

Task No. 3. To identify the bone tissue.

Structure: bone lamellae: Haversian-like conduit: bone voids.

Bibliography

Histology and microscopic anatomy compared to domestic animals. pp. 58 – 63.

Task No. 4. To classify the bone tissue.

Compact bone tissue and spongy bone tissue: structural and functional characteristics.

Bibliography

Anatomy of domestic animals. p. 6.

Veterinary physiology. Book 2. p. 909.

Task No. 5.

It is done independently; student will consider all the elements dealt with in tasks 1, 2, 3, 4, and 5.

Homework is assigned, the skills to be developed with their systems of actions, depending on the task, are handed in (or written on the board). Students are told to practice the skill of knowledge system, through a productive study, avoiding memorization of the knowledge system; they will be able to apply their knowledge and cognitive independence demanded from graduates today.

The skills to be developed in the homework assignment, along with their system of actions adapted to the subject are the following:

Task No. 1. To describe the bone tissue.

- To determine the structure for description.
- To observe the Haversian system.

- To design a description plan from a structural and functional perspective.
- To reproduce the characteristics of the bone tissue, according to the plan.

Task No. 2. To characterize the bone system

- To analyze the bone tissue from a structural and functional perspective.
- To determine the structure.
- To determine their functions.
- To study every structure and its functions as a whole.
- To determine the essential in the bone tissue.
- To compare the structure between different parts of the bone with other bones.
- To select the elements that typify bone tissue structurally and functionally.

Task No. 3. To identify the bone tissue.

- To analyze the bone tissue.
- To determine the structure.
- To determine their functions.
- To study every structure and its functions as a whole.
- To characterize the bone system
- To establish the type of bone tissue, and relate it to its function.

Task No. 4. To classify the bone tissue.

- To identify the type of bone tissue.
- To select classification criteria (structure and function).
- To gather the elements selected to determine the type of tissue.

Task No. 5. To relate the structure of bone tissue with its function.

- To analyze the structure and function of the bone tissue independently.
- To determine their relation criteria.
- To determine directional links.
- To determine inverse links
- To elaborate the conclusions about related elements.

Practical lesson No. 1.

1. The tasks assigned in Orienting Lecture No.1 will be developed, starting with task No.1. The skill and its system of actions

corresponding to this task is handed in, or shown on the board or poster, where it will stay throughout the task, though it is a simple task. Students are beginning to develop it, and have not internalized its actions. To achieve effective skill development, it must be a continuous, systematic, and conscious process.

2. The teacher will ask the questions, which may be reproductive, productive, or application questions. Then, after a reasonable time when the teacher addresses individual problems, a student will be selected to respond the question. If the answer is correct, and the other students have no doubts, a second question will be asked. If the answer is wrong or mistaken, the teacher should tell the students to follow the steps of the skills to design a new answer, and figure out where the problem is. This is appropriate to achieve self-regulation, and perform a more conscious learning process, which is fundamental to accomplish cognitive independence and application of knowledge, not only individually, but also collectively. If the answer is correct, but a particular student fails to understand it, and holds a different opinion, the student answering the question will present the system of actions to the class, in relation to the corresponding skill or task being addressed.

The teacher will only intervene when all the possibilities of students are exhausted. Hence, the teacher's work will be that of a facilitator and moderator; the student will be the subject and object of his own learning.

Orienting Lecture No. 2.

- I) To present the summary: Main bones in the skeleton.
- II) Question for the next class work: Can you relate the structure and function observed in the main bones of the skeleton?
- III) Assign the homework, system of knowledge of tasks, and the corresponding bibliography.

Head bones.

Cranial bones: occipital, sphenoid, interparietal, parietal, frontal, and temporal.

Bibliography: Anatomy of domestic animals. pp. 30 – 40.

Face bones: maxillary, pre-maxillary, palatin, nasal, lacrimal, malar, vomer, jaw, and hyoid.

Bibliography: Anatomy of domestic animals. pp. 43 – 52.

Trunk bones.

Spine: Cervical vertebrae, atlas, and axis. Thoracic vertebrae. Lumbar vertebrae, sacrum. Coccygeal vertebrae.

Bibliography: Anatomy of domestic animals. pp. 10 – 23.

Ribs.

Bibliography: Anatomy of domestic animals. pp. 24 – 27.

Sternum.

Bibliography: Anatomy of domestic animals. pp. 27 – 29.

Bones from front legs.

Scapula, humerus, cubital and radius, first, second, and third phalanxes (head, shafts, base).

Bibliography: Anatomy of domestic animals. pp. 65 – 85.

Bones from the hind legs:

Coxal: iliacus, ischium, and pubis. Femur. Tibia and peroneous. Patella.

Bibliography: Anatomy of domestic animals. pp. 86 – 99.

Tasks to be done.

Task No.1. To describe the different bones of the skeleton.

Task No.2. To characterize the different bones of the skeleton.

Task No.3. To identify the different bones of the skeleton.

Task No.4. To classify the different bones of the skeleton.

Task No.5. To relate the structure with function of different bones in the skeleton.

- I. Homework is assigned, the skills to be developed with their systems of actions, depending on the task, are handed in (or written on the board). Students are told to practice the skill of knowledge system, considering the teaching aids used in the two practical lesson activities, corresponding to the Orienting Lecture, namely the skeleton and isolated bones.

The skills to be developed in the homework assignment, along with the system of actions are,

Task No.1. To describe the different bones of the skeleton.

- To determine the bone to be described.

- To observe the bone.
- To design a description plan, to include the function of the bone.
- To reproduce the characteristics of the bone, according to the plan.

Task No. 2. To characterize the different bones of the skeleton.

- To analyze the bone with a structural and functional perspective.
- To determine the structure.
- To determine the function.
- To study the structure and function as a whole.
- To determine the essentials of the bone.
- To compare it with other bones.
- To select the elements that typify the bone, and to distinguish it from other bones.

Task No. 3. To identify the different bones of the skeleton.

- To analyze the bone with a structural and functional perspective.
- To determine the structure.
- To determine the functions.
- To study every structure and its functions as a whole.
- To characterize the bone.
- To establish the type of bone, and relate it to its function.

Task No. 4. To classify different bones.

- To identify the bone.
- To select the classification criteria.
- To gather the elements selected to determine the type of bone.

Task No. 5. To relate the structure with function of different bones in the skeleton.

- To analyze the structure and function of each bone independently.
- To determine their relation criteria.
- To determine directional links.
- To determine inverse links
- To draft conclusions about the interpretation of the structure-function relation observed in each bone.

- To study opinions from other sources, which can corroborate the final conclusion.
- To select logical rules that make up the rationale of this relation.

Practical lesson No. 2.

I) Tasks oriented in the Orienting Lecture No.2 will be addressed. The content to be dealt with is head bones, and trunk bones. The skills are presented along with their system of actions to be handed in, or on the board or poster, which will be shown throughout the lesson. The necessary aids will be used to conduct this activity, such as a skeleton, and isolated bones.

II) The teacher will ask the questions. Then, after a reasonable time when the teacher addresses individual problems, a student will be selected to respond task No.1. If the answer is correct, and the other students have no doubts, a second question will be asked. If the answer is wrong or mistaken, the teacher should tell the students to follow the steps of the skills to design a new answer, and figure out where the problem is. This is appropriate to achieve self-regulation, and perform a more conscious learning process.

The teacher will intervene only when the students have exhausted all possibilities.

The question presented in the Orienting Lecture No.2 will be answered.

Practical lesson No. 3.

I) The tasks oriented in the Orienting Lecture No.2 will be done; the content referred to the front and hind legs will be dealt with. The other steps will be the same as for practical lesson No. 2.

## Conclusions

This methodological guide is a way to develop professional skills through subject Animal Anatomophysiology in students of Agricultural Education Degree, based on the implementation of concrete actions in a flexible manner, and using several different levels of complexity.

## Author contribution

Humberto B. Sónora Revoredo: research planning, analysis of results, manuscript redaction, final review.

Riselda Guzmán Méndez: data collection, analysis and interpretation of results, redaction of the final manuscript, final review.

Ana M. Godínez Do – Val: data collection, analysis and interpretation of results, redaction of the final manuscript, final review.

Mariuska Simón Foustén: data collection, analysis and interpretation of results, redaction of the final manuscript, final review.

Biofredis Castro Torres: data collection, analysis and interpretation of results, redaction of the final manuscript, final review.

## Conflicts of interest

Not declared.

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