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## **Physical Education as a complementary subject in engineering careers in Ecuadorian Higher Education**

### **La Educación Física como asignatura complementaria en carreras de ingeniería en la Educación Superior Ecuatoriana**

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#### **ABSTRACT**

Physical Education in higher education provides tools and contributes to the quality of the teaching-learning process for the graduate, in this sense, the contents of the analytical syllabus of university degree courses demands from some adjustment according to the labor field's needs in order to train competent professionals. The aim of this article is to carry out a critical analysis on the existing proposals about the Physical Education syllabus that are taught in engineering degree courses in the higher education context. Among the main methods used were; bibliographic review, analysis of the documents, inclusion and exclusion criteria and evaluation of the quality of the selected articles. In first instance, Physical Education syllabi for university degree courses have as objective to prepare the future professional through the development

of physical condition (strength, speed, endurance and flexibility) through different sports such as soccer, athletics, basketball and others, promoting the physical culture, creating habits towards the practice of the physical-sport activity to keep and improve health. In second instance, the syllabus of Physical Education subject for the students of the university degree courses are directed to develop the general physical preparation, the specific professional skills according to the professional profile or the necessity of the labor field; and bilaterally keep and develop the physical capacities, both conditional and coordinative (strength, speed, endurance and flexibility).

**Keywords:** Physical Education; higher education; specific professional skills; specific professional preparation; physical condition.

## RESUMEN

La Educación Física en la educación superior aporta al egresado herramientas que contribuyen a la calidad del proceso de enseñanza-aprendizaje, en este sentido, los contenidos del programa analítico de las carreras universitarias requieren ajustes de acuerdo a las necesidades del campo laboral a fin de formar profesionales competentes. El objetivo del presente artículo es realizar un análisis crítico de las propuestas existentes sobre los programas de Educación Física que se imparten en las carreras de ingeniería en la educación superior. Entre los principales métodos se emplearon; la revisión bibliográfica, el análisis de los documentos, criterio de inclusión y exclusión y evaluación de la calidad de los artículos seleccionados. En primera instancia, los programas de Educación Física para las carreras universitarias tienen el objetivo de preparar al futuro profesional mediante el desarrollo de la

condición física (fuerza, rapidez, resistencia y flexibilidad) a través de los diferentes deportes como fútbol, atletismo, básquet entre otros, promoviendo la Cultura Física, creando hábitos hacia la práctica de la actividad físico-deportiva para mantener y mejorar la salud. En segunda instancia, los programas de la asignatura Educación Física para los estudiantes de las carreras universitarias están dirigidos a desarrollar la preparación física general, las habilidades profesionales específicas de acuerdo con el perfil profesional o la necesidad del campo laboral; y de forma bilateral mantener y desarrollar las capacidades físicas tanto condicionales como coordinativas (fuerza, rapidez, resistencia y flexibilidad).

**Palabras clave:** Educación Física; Educación Superior; habilidades profesionales específicas; preparación profesional específica; condición física

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## INTRODUCTION

Physical Education, according to Ruiz, and others as quoted in Mirabal, Menéndez, and Núñez (2011), considers:

"Physical Education is part of the pedagogical process and has as its specific purpose the development of the individual's physical performance capacity

based on the morphological and functional improvement of the organism, the improvement of its motor skills, the acquisition of knowledge and the development of convictions, in such a way that he is able to fulfill all the tasks that society indicates". (Page 12)

In Latin America, Physical Education is a subject that until now is part of the curriculum of the education system in some cases, since there are also higher education institutions that do not consider this subject in their curriculum.

Regarding the treatment of Physical Education in higher education institutions, there are contributions from national and international authors such as: Guàrdia (2004); Gómez (2005); Mozo (2007); Guapi, Dopico, H., and Gallardo, E. (2012); Granado, Stuart, J., and Tejera, J. (2015); Lovoratti (2016); Martínez, Santos, M..., and Castejón, F. (2017); Rodríguez and Gómez, E. (2018); Baños, Ortiz, M., Baena, A., and Zamarripa, J. (2018); and Valderrama, Linzmayer, L., Matus, C., Garrido, F., and Flores, C. (2018); who have carried out studies on the problematic of Physical Education in higher education in different contexts.

Of the foregoing, Fresneda, Herrera, A., and Álvarez, H. (2013), who propose an integrated Physical Education programme for the development of specific professional skills aimed at vocational training with an agricultural profile; Charchabal, Aguirre, A. (2013), who propose an integrated Physical Education programme for the development of specific professional skills aimed at vocational training with an agricultural profile; Charchabal, Aguirre, A., and Pérez, M. (2003), proposes an integral model for the educational teaching process from Physical Education in the career of Mining Engineering; Rodríguez (2009), emphasizes the

importance that Physical Education has in the development of the students of the University of Computer Science,

UCI; López, Morffi, A., and Arencibia, R. (2005), design a program of Physical Education for higher education; Concha C. (2005). Alarcón, G., Angulo, C., Ayona, A., and Guerra, J. (2014), carry out an analysis of Physical Education in Ecuador and the world; Rodríguez, Ruiz, F., and De Laosa, O. (2016), address Physical Education in Study Plan "E" of Cuban Higher Education.

Along the same lines, Fresneda et al. (2013) consider that physical education in higher education institutions provides the graduate with an integral formation that guarantees the quality of the teaching-learning process from this subject, affecting the social-affective, cognitive and motor spheres that are promoted in classes. Consequently, Physical Education has an integrating role that is revealed in the link with other subjects of the career.

At present, in the Republic of Ecuador, the subject of Physical Education "...is the compulsory subject taught at all pre-primary, basic general education and Baccaureate levels as a physical, cultural and humanistic training activity for students. Aldas and Gutiérrez, H. (2014), p. 1. With regard to higher education, no research has been found on the existence of a Physical Education program, established to teach Physical Education classes according to the profile of the engineering and bachelor's degrees offered in the polytechnic schools and universities of the Republic of Ecuador.

## MATERIALS AND METHODS

In order to fulfill the objective of the present study, a critical analysis of scientific researches that propose Physical Education programs for engineering careers in higher education institutions was made; for the development of it and according to Vera (2009) and Cué, Díaz, A.; Díaz, M. and Valdés, A. (2008), there were used the following research methods:

The bibliographic review, to carry out the systematic review of scientific documents related to proposals for Physical Education programmes in higher education.

The analysis of the documents, with the purpose of knowing the theoretical

foundations that sustain the different proposals of the subject.

The criterion of inclusion and exclusion, in order to select the proposals referring to the contents of Physical Education that is taught in the engineering and degree courses; on the other hand, the discarded articles were the proposals around contents directed to students of the Physical Education course.

The evaluation of the quality of the selected articles, through the evaluation of the purposes, primary sources, results or proposals of the original articles

## RESULTS AND DISCUSSION

### Physical Education in Higher Education

Physical Education from antiquity to the last decade, has been approached by several authors from diverse currents or approaches; it is thus that criteria are emitted on it from the education, the health, competitive level, the recreation and the social thing; according to Fresneda and

others., (2013), among the main currents that focus the Physical Education are found:

- From education, therefore, the field of action is the school and the educational system in general.
- From health by considering Physical Education as a promoter of health, with the

intention of preventing diseases.

- At a competitive level from the point of view of sports training for the development of high performance;
- From the recreation taking into consideration the ludic activities to link the subject with the environment.
- From body expression through the influence it receives from dance, yoga and music.

This article analyzes Physical Education from the perspective of education and specifies various definitions of it, according to Charchabal and others (2003):

"Physical Education is conceived as a harmonious set of different forms of obligatory and optional activities that are carried out in school and outside it. (p. 1). Physical education at the school level is undoubtedly booming and has prestige due to the morphological and functional benefits of the organism in addition to educating students through physical exercise in the classes of the subject.

According to Concha et al. (2014), to define Physical Education, reference is made to the essential traits that characterize it; it is considered as a pedagogical discipline that contributes to an integral education and has the purpose of improving motor skills. It is conceived as a discipline, but not as a science because it focuses on the study of an object; pedagogical, since it is part of the disciplines that make up the educational curriculum; integral education, since it contributes to the education of the main aspects of man and distances itself from the ancient conception of the human being as a sum of body, mind, and soul; and motor skills, since their field of action is the motor skills of man through the body and motor practices of man.

In order to analyze the main definitions of Physical Education, it is necessary to start from the fact of considering it as a discipline when analyzing it from the educational sphere; therefore, like the other disciplines, it has a pedagogical character since it educates students in an integral manner, with the teacher guiding the process; through physical exercise, physical condition is

developed through the work of basic motor skills.

One of the definitions that fits the present research assumed in this article is that one proposed by Ruiz, and others, as cited in Mirabal, Menéndez, and Núñez (2011):

"Physical education is part of the pedagogical process and has as its specific purpose the development of the individual's physical performance capacity on the basis of the morphological and functional improvement

of the organism, the formation and improvement of its motor skills, the acquisition of knowledge and the development of convictions, in such a way that it is able to fulfill all the tasks that society points out. (Page 12).

In most countries of Latin America, Physical Education is part of the structure of the education system and is provided at the basic, middle, and higher levels; at each level, the objectives and contents contribute and pursue the same goal that coincides with the approaches discussed above. In the Republic of Ecuador, Physical Education at the higher level is aligned with what is stated in the Law on Sport, Physical Education and Recreation, in force since August 10, 2010, in the eighteenth general disposition, which states: "Physical Education is a discipline that bases its actions on the teaching and improvement of body movements, seeks to form the human being in an integral and harmonious manner, positively stimulating their

physical capacities" (National Assembly, 2010, p. 24).

In this sense, and in accordance with the Law of Sport, Physical Education and Recreation, the universities and polytechnic schools of the Republic of Ecuador have the objective of developing and improving the physical, technical, tactical, psychological and volitional qualities of the students through the practice of a specific sport; therefore they are limited only to the practice of football, basketball, athletics, among others; however, through Physical Education classes, professional skills specific to each profession can be developed.

According to Fresneda and others (2013), Physical Education in Higher Education provides the graduate with tools that guarantee the quality of the teaching-learning process of the subject, affecting the social-affective, cognitive and motor spheres that are promoted in Physical Education classes. Consequently, Physical Education has an integrating role due to the link that it has with other subjects of the career and not limiting itself only to the improvement or development of the professional's physical condition through the exercise but also contributes to the integral development by affecting the social-affective sphere through games or exercises that promote the cohesion of the group and values, and in the cognitive sphere through reasoning games the intellectual part of the student is worked on; in addition, through Physical Education the specific preparation and specific professional skills necessary for the professional future can be developed.

Once the bibliographical review has been carried out around studies on the programmes of the Physical Education subject taught in higher education, there is evidence of programme

proposals in two positions or slopes, in the first, programmes with the aim of preparing the professional future through the development of the physical condition through different sports such as football, athletics, basketball among others, thus creating a culture towards the practice of daily physical activity; in the second aspect, programs with the objective of preparing the graduates according to their labor field, that is to say, through Physical Education classes to develop abilities proper to the profession without leaving aside the physical preparation. For this reason, 4 articles were selected that refer to or propose

programs to teach Physical Education classes in higher education.

### **Analysis of the proposed programmes to be taught in the subject of Physical Education in Higher Education**

For the development of the present work, the original articles of revision are grouped according to the objectives that they pursue; the first group has the proposal that Lopez and others propose. (2005), where they design a program of Physical Education for the Higher Education in order to apply the theory of the design by means of the competence; like second article, Rodriguez and others., (2016), address the analysis of the basic elements that sustain the new approach to Physical Education in Study Plan E with the objective of clarifying the foundations for the harmonious application of the study plan based on contradictions regarding the conception of the Physical Education subject.

The second group has the third article where Charchabal et al. (2003), propose an integral model of the teaching-learning process of Physical Education for the career of Mining Engineering, and as fourth article,

Fresneda et al., (2013), propose an integrating program of Physical Education for the development of the specific professional skills directed to the professional formation with agricultural profile.

Giving continuity to the development of the section it is offered the analysis of the first original article where López et al. (2005), design a program of Physical Education for Higher Education in order to apply the theory of design through competition. In the analysis work they propose to develop

in the students both the conditional and the coordinating physical capacities and to improve the formation of values through sports games and physical exercises with a competitive character.

The program aims to train the future professional in a holistic way focusing on physical, intellectual and educational development through the formation of values for which the following contents are proposed:

Declarative contents: (general description that includes the great ideas)

- The physical tests.
- Exercises for self-preparation.
- Technical tactical actions of physical activity that is selected to play, fight or compete.
- Fundamental rules of the sport that is selected to play, fight or compete.
- Importance of physical exercise for health.
- Development of sport and physical culture.
- Most relevant figures of the sport. Sports participation system.
- Food, hygiene and health.

Procedural contents: (procedures, methodologies, methods, techniques,

among others. Included in the competition).

Attitudinal content: (attitudes that are put into play when carrying out the competition, including the values that make them possible).

- Will.
- Socialization.
- Honesty.
- Courage.
- Responsibility.
- Constancy.

- Loyalty.

The program is based on the development of Physical Culture through the learning results of students in three directions, habits of systematic practice of physical exercises, formation of values and physical recreation. To criterion of the author of the present article to direct the program of the Physical Education subject only for the development of the physical performance, the motor abilities and the theoretical knowledge of the basic sports do not contribute to the development of the specific professional abilities and specific preparation of the professional future, having in consideration that at present it is tried to form professionals apt to face the labor world in both physical as intellectual levels, reason why it is important to endow to the university student of the specific contents of a determined career allowing this way he gets a better performance and to stand out in his daily activities.

The original article does not have the characterization of the physical performance, the physical exercise, and the formation of values considering that they are the aspects that sustain the investigation, in addition there is a generalization of the contents, reason why it does not provide sufficient information for the application of the same ones; it does not specify to the population the

proposal is directed to, the number of semesters that must pass the students to meet the program objective.

The second article analyzes the proposal of Rodriguez et al. (2016), which examines the basic elements that sustain the new approach to Physical Education in the Plan of Study E of the Republic of Cuba, with the objective of clarifying the foundations

for the harmonious application of the study plan based on contradictions regarding the conception of the subject of Physical Education. The authors refer to the transformation that the conception of Physical Education has undergone in Cuban Higher Education through the different study plans that have as their starting point study plan A, up to study plan E.

The proposal is based on the objectives pursued by Physical Education at the higher level according to study plan E; this is how Rodriguez et al. (2016) propose that:

"Physical Education must be directed to the development of students in the physical, educational and social areas, and contribute to forming a healthy graduate, with a level of physical culture that guarantees their harmonious development and a better quality of life. (p.25); according to the proposal, the program is structured by objectives, contents, teaching-learning, evaluation and teaching materials. In order to continue with the analysis, some elements of the proposal are presented.

Within the contents it is the diagnosis of the student's physical condition, which provides theoretical knowledge for health, teaches the student for self-exercise, as well as warm-up, recovery and work of conditional physical capabilities within which it is found strength (strength of arms, trunk strength, leg strength), speed,



endurance and mobility. Gutiérrez, (2010).

As for teaching-learning, theoretical knowledge concerning health should be planned in such a way that it is subdivided into several class sessions so as not to spend excessive time imparting the theory. The self-exercise of physical exercise is a pedagogical tool that develops skills and motivates students for the appropriation of knowledge in Physical Education classes; as Rodríguez and others propose (2016):

"The self-exercise of physical exercise does not respond to the traditional teaching of Physical Education because it modifies the total protagonism of the teacher, in that the decisions were only his and the function of the student consisted in executing and obeying any indication about the place, initial moment, rhythm, intervals, etc." (p.31).

In spite of the fact that the proposal is framed in the current tendencies that link physical activity and health according to Study Plan E in the Republic of Cuba, where they propose a single teaching program for all university careers; in view of the proposal, it must be taken into consideration that the professional must be prepared for the world of work both physically and intellectually, as

for the latter, the professional future must possess knowledge of the profession and develop skills specific to the profession that can be taught through Physical Education classes.

As a result of the first group of analysis it is inferred that the proposals of Physical Education programs for university careers prepare the future professional through the development of physical condition (strength, speed, endurance and flexibility) through different sports such as football, athletics, basketball among others, promoting Physical Culture, creating habits towards the practice of physical-sports activity with a favorable impact on health. As an element to emphasize is that the authors propose to promote the self-exercise of the physical exercise in the students; which due to the fact that the subject is optional, and in other cases this is given in an obligatory way, many of the times does not satisfy the interest of the students, which gives rise to that the student when leaving the classes does not put into practice the acquired knowledge.

In the second section, two original articles that pursue similar objectives are grouped together. In the third article of analysis Charchabal et al., (2003) propose an integral model of the educational educational process of Physical Education for the career of Mining Engineering. The researchers consider that Physical Education strengthens the health of the human being to develop and perfect physically; it exerts a positive, substantial influence in the spiritual world of the individual, in his emotions, aesthetic tastes, it opens wide possibilities for the formation of the conscience and of a highly moral conduct.

When talking about physical development and improvement, reference is made to professional

physical preparation, since not only do professionals develop both conditional and coordinating physical capacities, but also the capacity for analysis and

generation of ideas, these two aspects being the basis for said research. Now, what is the definition of professional physical preparation; according to Brikina (quoted by Charchabal et al. (2003), raises:

"Professional physical preparation is oriented to the rapid assimilation of the future specialty, unlike general physical preparation, which can be common to all, professional physical preparation is differentiated by taking into account the characteristics of future work activity. (Page 1)

Within the work, the professional physical preparation develops the muscular groups, that carry out the fundamental work of the labor activity, and also the development of the motor and vegetative functions, necessary for the professional future. The professional physical preparation is considered as the specific preparation of the professional, therefore the contents of the Physical Education course must be delimited to the specific characteristics of the Mining Engineer, because depending on the activities that the professional is going to carry out in the field will be the technical and theoretical contents that must be acquired in the course.

The authors consider that the professional physical preparation is the cell of the formative process of the career of Mining Engineering, because in it all the components and laws of the teaching educational process of the Physical Education are manifested; as they are the objectives, contents,

methods, means and evaluation manifesting implicitly the relation

among all these components of the process and the social context.

Within the model of the educational process of Physical Education for the career of Mining Engineering it is proposed to approve in the first and second semester of the career the sports judo, swimming, soccer and weightlifting. However, the author of this article does not consider or analyze the fact that there are students who have not practiced weightlifting since early ages, which can lead to the appearance of injuries "...strength training at early ages can be a factor in injury prevention". Cuervo, C.; Fernández, A. and Valdés, R., (2013), p. 143).

In the fourth analysis article Fresneda et al. (2013) propose an integrated Physical Education program for the development of specific professional skills aimed at vocational training with an agricultural profile. According to the authors of this article, Physical Education, in search of the quality of its discipline, performs exercises not only for the development of knowledge, skills and psychomotor abilities (conditional and coordinating) but also aimed at postural correction.

In this sense, the practice of Physical Education in Higher Education must be directed to three areas: sports, corrective and recreational, and in a specialized manner, according to the profile of the careers; in the case of the Agrarian University of Havana "Fructuoso Rodríguez Pérez", the subject is taught in four semesters in the first and second year of the career. When the diagnosis is made, the following deficiencies in the research are established:

- There are inadequacies in the treatment of professional

- training, specific professional skills are not developed.
- The development of skills does not correspond to work performance in the link with Physical Education classes.

In the analysis article, professional skills are characterized, for which it is started by defining the general skills where it is assumed the approaches of authors from the 80s up to the present; authors such as: Talizina (1984); Lafourcade (1986); Vygotsky (1987); Álvarez de Zayas, C. (1992); Smith, A. D. and Brito, C. (1997); Labarrere, G. and Valdivia, G. (2000); Arceo, F. D. B.; Rojas, G. H., and González, E. L. G. (2002) and Bermúdez Morris, R. and Pérez Martín L. (2004). The authors present the essential traits that characterize the skill within professional competencies:

- The possibility to carry out an action.
- Operations become habits.
- Ruling function of the motive in the activity.
- The way in which knowledge is assimilated and applied (i.e. know-how).

As for the professional skills in the original article, there is a superficial characterization, and therefore, in the opinion of the author of this article, there should be an epigraph that deepens on this aspect, bearing in mind that professional skills within professional competencies have been addressed from several educational sciences.

The specific professional skills with an agricultural profile to be developed include cavalry (knots and moorings), distance and height estimation, swimming and rescue, riding (preparation and horse riding) and orientation in the field. The same ones that they must develop by means of

the subject of Physical Education in the faculties of Veterinary Medicine, Agronomy and Agricultural Mechanization.

Considering that the program is proposed to be implemented in the Faculty of Veterinary Medicine, and to adapt to the Faculties of Agronomy and Agricultural Mechanization; it is considered that before generalizing the previous studies of the professional profile should be made and to consider the objectives of the curriculum of the faculty.

As a result of the analysis of the second section of the third and fourth original articles it is inferred that the programs of the Physical Education subject for the university careers are directed to develop the general physical preparation, the specific professional skills and the both conditional and coordinating physical capacities (strength, speed, endurance and flexibility) in the future professionals; where they propose to implement programs of Physical Education according to each university career, that is to say, the contents of the analytical programs are in function of the own activities of the profession without leaving aside the development of the physical condition of the students and consequently of the future professional.

However, in order to end with the analysis of the original articles and without the objective of having absolute reason or giving a criterion on the objective validity of a particular program or other subject of Physical Education for university careers; The author of this article assumes the second position or slope that is raised during the development of the work, which responds to the integral formation of the future professional

according to their field of work or the contents of the Analytical Program of

the Physical Education Subject should develop general physical preparation, specific professional skills and physical abilities both conditional and coordinating. It is clear that the design and implementation of programs are conditioned by the objectives of a Faculty's Study Plan, the Statute of the university or polytechnic school and, above all, the Constitution of the Republic of a Nation.

As mentioned during the analysis of the current articles in Latin America professional training must be in line with the needs of the labor field becoming a challenge for higher education. In almost all universities the subject of Physical Education in engineering careers is optional or complementary where students attend classes on a mandatory basis for the most part resulting in a lack of interest in learning the knowledge taught in class. Therefore, if knowledge is taught that complements the formation of the future professional, students will become interested in the subject and will not see it as a knowledge that is not useful in the career.

Physical Education from antiquity to our days, has been approached by several authors from different currents or approaches, from education, health, from the competitive level, recreation and social. Approaches that define it according to its object of study; in the

field of education at Latin American level, Physical Education as a complementary subject in university careers has evolved significantly, since it has gone from the conception of training athletes to the current trend that is to train professionals according to their field of work without leaving physical condition aside.

In the first instance, the programs of Physical Education for the university careers have the objective of preparing the professional future by means of the

development of the physical condition (force, rapidity, resistance and flexibility) through the different sports like soccer, athletics, basketball among others, promoting the Physical Culture, creating habits towards the practice of the physical-sports activity to maintain and to improve the health.

Secondly, the programs of the subject of Physical Education for the students of the university careers are directed to develop the general physical preparation, the specific professional abilities according to the professional profile or the need of the labor field; and in bilateral form to maintain and to develop the conditional and coordinating physical capacities (strength, rapidity, endurance and flexibility).

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