Formative dimension of high school student from axiological potential of Physics at the UANL, Mexico

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Abstract

This article assesses from the epistemological characteristics of physics and its potential for achieving higher education of personal and social connotation on the student. It discusses the features of physics that allow preparing a teaching-learning process where the cognitive manifest in harmony with the feelings related training, skills, values, ways of thinking and acting. The exposed means that the dynamic of the process needs necessarily to combine the individual and group, the personal and social. They are based requirements and demands which must be taken into account in the design and implementation of educational programs in Physics at the Higher Secondary Education to promote the integral formation of students.

Keywords: Formative dimension, axiological potential, physics, teaching- learning, integral training.

Resumen

El presente artículo valora desde las características gnoseológicas de la Física, y sus potencialidades para el logro de una formación de mayor connotación personal y social en el estudiante. Se analizan las características de la Física que permiten estructurar un proceso de enseñanza – aprendizaje donde lo cognitivo se manifieste de manera armónica con lo formativo relacionado con los sentimientos, cualidades, valores, formas de pensamiento y actuación, etc. Lo expuesto significa que la dinámica del proceso debe necesariamente conjugar lo individual y lo grupal, lo personal y lo social. Se fundamentan requisitos y exigencias que han de ser tomadas en cuenta en la concepción e implementación de los programas docentes de Física en la Educación Media Superior para favorecer la formación integral del estudiante.

Palabras clave: Dimensión formativa, potencialidades axiológicas, Física, enseñanza- aprendizaje, formación integral.

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I. INTRODUCTION

We know the need to foster a more comprehensive understanding of the teaching and learning of Physics in a way that the student is not a mere repeater of the teacher's explanation, but that the knowledge acquired through study of this subject harmonize with general education, which integrates the cognitive and axiological. To achieve this purpose is required to apply a different dynamic that developed every day, according to what is observed in practice, so this process transcends the limits of the epistemological and favors a more comprehensive training of the student.

II. DEVELOPMENT

As nature science, Physics has great potential for the contribution from an epistemological position can make to the integral formation of students. On one part, understanding them requires a series of mental procedures that can be used in different activities and the other, its own conceptual apparatus has wide applicability to different processes and phenomena of life in general.

For Diaz, "(...) scientific knowledge is characterized as descriptive, explanatory and predictive, critical and analytical, methodical and systematic, controlled, unified, logically consistent, communicated through language precise, objective and provisional" [1], this author suggests the following additional features: foundation (logical coherence and empirical), systematic, explanatory and

predictive capacity (laws) of reality, a critical nature; ambition of objectivity.

Mario Bunge for his part, notes that "(...) science, its method and its legal philosophy (searches laws, with which it explains, predicts and recalls the facts) based (logically and empirically), systematic, methodic, temporarily, with pretension of objectivity (...)" [2].

This allows synthesizing scientific knowledge, is knowledge from this approach the knowledge of Physics as scientific knowledge is characterized by:

• Rational, referring to the material world and that can be tested by experimental methods.

• Descriptive, explanatory and predictive. Because attempts to describe the phenomena it studies explaining its operation and anticipate how these phenomena will behave in the future.

• Methodical and systematic. Because it follows certain guidelines or methods to account for their research, and is built on a system of theories that support it.

• Contrast. His theories and methods are public.

• Clear and precise. Because their explanations should be free of ambiguity.

• Objective. To prevent by all means the researcher's subjective view.

• Provisional. Because knowledge tested today can be refuted tomorrow superior knowledge.

• Critical. By constantly questioning interim knowledge that has not been refuted.

These features are of great value for the conceptual methodology of the student training, as the target for understanding the nature of science should have direct implications for their teaching. Thus, the curriculum should include some sort of updated content from history, philosophy and sociology of science, however, in practice usually does not happen.

Different authors provide suggestions on the role to play in philosophy of science on these issues and aspects of it that should be addressed in the teaching and learning of Physics [3, 4, 5, 6, 7].

The teaching and learning of Physics must be consistent with the epistemological nature of this science. His epistemological logic indicates that this process is necessary to take into account:

- The planning intention of Nature Physics.
- The coincidence and coherence of the nature of Physics with the facts, concepts and procedures, which are taught.
- Consistency between learning activities and resources used in the classroom with the nature of Physics is required to teach.
- The level of knowledge by teachers of different paradigms about the nature of science.
- The ability of teachers to understand that Physics and science in general and from its peculiarities, can be a source for the cultural development of the student.

Related to this is necessary to point out that although teachers possess a philosophical, historical and sociologically rich and thoughtful sight about science and scientific work, we should not forget that this is no guarantee that their students can gain a better understanding of the nature of this science and the development of scientific knowledge [6]. Similarly occurs in the known fact that a good command of the subject to be taught by teachers, although essential, does not ensure adequate learning by students.

In the above affect many other factors that will undoubtedly make you lose much of the epistemological discourse coherence when moving from theoretical to practical educational problematical revealed in some of the issues expressed above. In the context of teaching practice, the risk of transmitting an image of the inadequate science (even implicitly and unintentionally through the scientific discourse of teachers in the classroom), leads to a concrete conclusion first: avoid visions widely overwhelmed and distorted about the nature of science, as empiricism inductivist, the belief that scientific knowledge grows only cumulative, infallibility, the universality of scientific method, understood as a mechanical algorithm that leads to success, the myths or objectivity and neutrality of science, individualism and de-contextualization in the genesis of scientific knowledge.

The widespread practice in Physics classes to separate theoretic classes from the practical may be harmful if not developed a methodology carefully studied. It can lead to consideration of that observation and theory are independent, and that the former is above and hierarchically superior to the latter. This approach is especially risky when the achieve the most simple and direct observations and measurements, where the tendency to regard most obvious and free of any theoretical charge is more immediate, it is also evident in the practices raised as recipes to follow, rather than with a vision of open problems to solve.

One of the peculiarities of Physics, as fundamental science, is that with the knowledge it provides, its importance should be sought increasingly through its application in practice.

Other features to note is that the first fundamental knowledge that their applications are concerned, and at a given accumulation of basic knowledge outweigh its applications. For this reason, the link between theory and practice has great importance in relation to the formation of the scientific world.

Also, between the epistemological features of Physics is its interaction with other sciences, an issue of vital importance in achieving a broad, multilateral development in students.

Between the Physics potential that has to favor the formation of the student not only in cognitive, one can mention the following.

1. The application of theoretical models in different branches. Predicting the behavior of the physical world is impossible without the knowledge of Physics.
2. Intellectual skills, such as observation, demonstration, analysis, evaluation and description, among others, developed through the study of Physics, are essential for

the proper performance of any person in both his professional life as in relation to others.

3. The study and insight into the essence of physical phenomena by interacting with them, allows students a transformative attitude and position towards reality.
4. By analyzing the physical aspects that affect the natural conditions may develop a greater sensitivity to detect human and propose improvements to assess conditions harmful to the environment.
5. The study of Physics allows understanding the main concepts in their articulation with the laws, theories and models, assessing the role they play in the development of society.
6. The knowledge of Physics allows to obtain and evaluate information from different sources, which develops critical thinking and their own opinion on world problems related not only to physics, but appreciating the contributions of other fields of knowledge.
7. Understanding the development of Physics as a dynamic process, without dogma or absolute truths, enables the development of a flexible and open about different opinions.
8. The acquisition of autonomy to use Physics in different contexts, critically and creatively, the learning acquired, enhance the importance of responsible participation and collaboration in teams.
9. Study of Physics produces an emotional effect always the wonderful possibilities of physical phenomena, are discover its wide applicability, ranging to explain the simple drop of a fruit, as far as, how the domain of Physics with other sciences has send men into space.

Dynamics of teaching and learning physics in high school

The authors take into account the principles of Vygotsky [8], in particular those related to the Zone of Proximal Development, which allow us to understand that:

1. Students may participate in entirely new activities or situations that are capable of working with their peers.
2. In real problem solving with a given level of abstraction should not always be predetermined steps or fixed roles of the participants, the solution should be distributed among the participants, the change in the distribution of activity with respect to the task favors learning.
3. The development is closely related to the range of contexts that interacts with an individual or social group.

These ideas are of great value in the High School Level since at this stage of development increases the need for students to interact and share knowledge, experiences, for this the interaction is essential.

For this level has a paramount importance both for its place in the formation of the citizen who needs today's society, as training the student should possess upon entering college. The profile of graduates of high school level in Mexico hopes that the student meets certain requirements, among which are:

"To possess a social and humanistic education that sparks their interest in the economic, social, legal and political phenomena that constitutes modern life, and allow you to understand them in their historical and social context. Efficient access to language, both oral and written, and express knowledge in their own words, develops skills and abilities that characterize rational thought, objectivity, critical and expressive clarity. Appropriating a culture that supports staff development and promote the pleasure and recreation in the arts, sports and respect for others and their environment, can be understood in a process of globalizing society of rapid change and the need to communicate effectively with others" [9].

To achieve the aforementioned aspirations required a teaching-learning process according to them, this process is primarily focused on the content, program application and the actions of the teacher, will be virtually impossible to achieve the purposes mentioned.

In accordance with the foregoing, the teaching-learning process should lead to a student's education that transcends the domain of physics. In the present investigation is shared with Flores Ochoa: "(...) the training development process is undertaken consciously" [10].

This definition clearly states that the training was not achieved by an influence from outside. When influence is exercised through the means and resources used by the teacher's guidance and explanation, without a conscious participation of the student, then no real training is achieved.

This development process consciously assumed by the student must have a socially valuable purpose, therefore has an integral character, therefore the formation of this nature is assumed as "(...) the process by which the student learns to know oneself and the world around him, to transform this world and achieve their own self-transformation, to live with others with the aim of contributing to their development in feeling, thinking and acting on society in general" [11].

If the student feels a great interest in learning to meet their needs and does not understand the usefulness of social development, it is a training limited, partial. Moreover, if the student focuses on learning from the social and dismisses the satisfaction by the process and results in the absence of intrinsic motivation, learning is incomplete. Hence, the unity of the understanding of social meaning and personal interest in learning, is a condition for a learning process involving the student in many situations where not only acquire knowledge but also attitudes and values.

The above means that the dynamics of the process must necessarily combine individual and group, personal and social. The methodology to teach the classes in Physics must possess as final purpose not only the achievement of expected learning, but to be an effective contribution to the integral training.

Here it is argued the concept that has been the basis for the development of teaching methods. Constitutes the theoretical foundation of itself to devise a comprehensive training system (all) consisting of two subsystems

fundamental. **Methodological and Conceptual Training Cultural Training.** Fig. 1 [12].

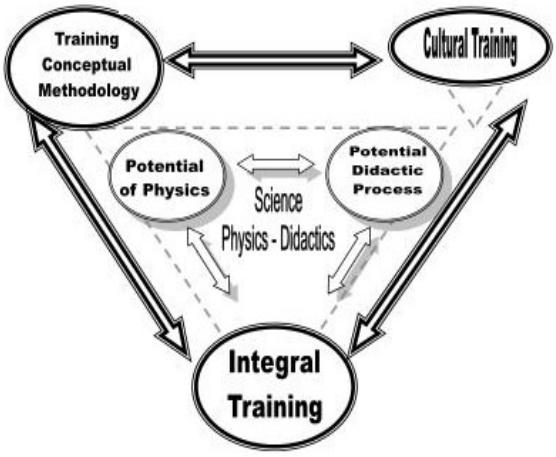

FIGURE 1. Subsystems for the design didactic all-round education for students through the process of teaching and learning of Physics.

The diagram above indicates that the integral formation of students through the process of teaching - learning of physics can be achieved when the conceptual of Physics and its methodological instrumentation allow a development of the student by mastering the conceptual apparatus as well as methods, strategies and proceedings for it. This concept is identified with consideration of the student as a subject and is contrary to the traditional way of teaching physics that still prevails in teaching practice.

The first component: Methodological Conceptual Training is determined by the system of knowledge, skills, work strategies of the subject, methods and means to learn, the physical conceptual system and contents of this science as a whole.

As for Methodological Conceptual Training concept to develop in students an understanding of the physical world as a whole, that the different processes, phenomena are interrelated, in addition that the separation is only a methodological procedure for study. From this it follows that the cause-effect relationships, as a universal law, are evident in the manifestation of that single.

Methodological Conceptual Training occurs in close interrelation with the cultural background of the student if the student learns not only physical but also the specific methods, are new elements that enrich their cultural background.

The conceptual system of Physics as a science, manifested in specific content that students study in the teaching program of upper secondary level may be an effective way to train not only the student's conceptual formation, but also for the appropriation by them of the methods to "learn to learn".

The second component: Related to the student's cultural background, is determined as a theoretical construction, related to the characteristics of this science, which tells you how to study and systematization of physical phenomena and their interpretation, based on principles and laws General operating in the physical world.

Cultural Training of students in the development of Physics classes can be realized when applying a comprehensive approach in its study. To this end, it is appropriate the analysis of the different stages of development of physics as a science, the trends that have emerged in the historical development of each stage of this science, the knowledge of the leading scientists in this field, recognizing its importance to social development, their relationship and application in everyday life.

General Physics to be a science of nature, indicates the need to describe, interpret, explain, analyze, model and observe the different phenomena. For this reason, when it is learned by the student's cognitive processes can lead to an interpretive thinking. This is because the power to interpret the physical phenomena, these skills can be transferred to other phenomena and other areas of performance and knowledge.

The third component: is determined by the integral study of physical phenomena by a methodology to achieve this goal, then this understanding will be complete, total, where observed, modeled, interpreted, described, argued, will interact with the phenomenon studied and verified it. This procedure allows the students to develop a vision that is applicable to any field of knowledge and action. In this case, shows how the interplay between epistemological logic of Physics and logic interpretation can enhance the student's cultural background, open new horizons in the way of understanding the world.

Taking into account the above mentioned. The teaching that encourages a comprehensive education is one that allows the knowledge assimilated by the student to have a sense for their scientific and humanistic formation. The methodologies and strategies allow foster a sense, because they are dynamic elements of the process. The creative direction is par excellence, has a personal nature, therefore it is essential that different approaches are used and integrated into the collective work.

A teaching methodology that promotes the personal significance of the symbolic language of Physics in correspondence with its scientific meaning, while being used as a learning tool with meaning and sense to the students, promotes the development of theoretical thinking and complacency by the study of the subject.

Science teaching from their own object spaces can lead needed to build the unity of meaning and sense in students. If this relationship becomes aware, by both teachers and students, it will be difficult to get an education that transcends the framework of the field of Physics. If this becomes conscious intentionality and character not only instructive but training is no guarantee in all its fullness of meaning and unity senses.

The coherence between the meanings and related senses oriented to humanize the teaching process favors the formation of the student, allowing their development in conjunction with the cognitive level, his training as a human being.

The construction of meanings and senses in the process of teaching and learning of Physics does not mean only the creation of settings for student learning is also related to the direction and conduct of teaching, so that the student a approach in a progressive way to the representation of the contents of Physics as cultural knowledge.

When the teaching of Physics starting from the student's preconceptions, even misconceptions, the new being studied and that causes a contradiction, can help make sense of what you learn, motivated by the knowledge and its application.

Only makes sense when in addition of meaning there is a significant of practice in reality. For this reason, the motivation has to be an intrinsic component of the process if there is no motivation there is no interest, so for the student the Physics, has no meaning or sense. Also, when starting of the experience they have on the content to be treated, they find the meaning because they understand its relevance, its usefulness.

The educational process has unlimited potential because the communication teacher student also keep determinant places among themselves, a matter which makes them acquire an experience of coexistence, cooperation, mutual respect and many other values that enrich the axiological dimension of the learning process. However, not all educational process takes place effectively at the address pointed for that it must meet, among others, the following requirements:

1) Put in the center of the process the student as a subject that must not only contribute to its formation, but the elimination of its negative aspects.
2) Getting the students to accept the teaching-learning process can be an effective means of training and self-transformation, not only as professionals but as human beings in general.
3) Conjugate adequately the social and the personal, group and individual.
4) Ensure adequate communication teacher-student and student-student that allow reflection self-reflection and constant enrichment.
5) Provide students with the means to become aware of their own characteristics and those of their classmates and teachers.
6) Make use of disciplinary content to develop reasoning skills, according to the limits and scope of subject matter that can be transferred to other social and personal tasks.

III. CONCLUSIONS

In keeping with the analyzed epistemological characteristics in Physics as a science, as reflected in education programs, coupled with the potential of his educational process in the high school level can be an effective contribution to the integral formation of students as long as the conditions for it are created.

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