

THE HIGH SCHOOL CURRICULUM OF PHYSICS IN ARGENTINA

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1 INTRODUCTION

The present work deals with the curricular proposals for high school (HS) physics education made by the national government of Argentina. Some subjects about the actual curriculum developed at schools, as well as the minimal requirements for incoming students to scientific - technological university careers (STUC) in three argentine universities -National University of Northeast (UNNE), National University of Misiones (UNAM) and National University of El Litoral (UNL)-, were studied.

We found serious difficulties in the academic formation of the students during HS. The results show that the physics contents proposed by the national government have been adapted by the different state jurisdictions with no uniform criteria, so the students who finish HS have not a homogeneous basic academic formation in physics. Some students could have attended no physics lectures; others could have attended them for one year, and in the best case, for two years. On the other hand, the lab work in physics classes is poor, in the contrary sense of the government proposals.

It is important to note that not only the basic knowledge in the first years of STUC includes physics, but also the necessary specific competences in the incoming students to these careers are strongly related to this discipline.

1.1 National Normative: Education Federal Law in Argentina

The HS education in Argentina has the following characteristics:

- It is non-obligatory for the young who are between 15 and 17 years old.
- It is preparatory to introduce students into the world of work and to continue studying at the university level.
- It is non-centralized. The HS education depends on each jurisdiction normative.
- It is non-unified. There are different curricular designs in each of the twenty four jurisdictions in Argentina.
- It involves different modalities: Natural Sciences, Goods and Services Production of the Organizations, Economy and Management,

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Communication, Art and Design, Humanities and Social Sciences, and Technique.

1.2 The Physics theoretical curriculum

The physics curriculum of HS education involves two physics courses, called First Physics Course (FPC), and Second Physics Course (SPC). The first one is common for all modalities and obligatory only for Natural Sciences. The second course is obligatory only for Natural Sciences, and optional for the other modalities.

The conceptual contents for the FPC are: work, energy, waves, electricity, thermodynamics and physics optics. The structuring concept is energy. In the SPC the conceptual contents are: cinematic, dynamics, work, hydrodynamics, elasticity, physics optics, electrostatics, magnetisms and production processes of the scientific knowledge. The structuring concept in this case is waves.

1.3 Achievements expectations in the First and Second Physics Courses

In the national normative of HS education the achievements expectations related to the FPC and SPC are established. The achievements expectations related to the FPC are: to describe and to calculate energy changes using the concepts: work, heat and radiation; to explain physic phenomena using conservation and degradation properties of energy, to describe natural processes and to explain how technological objects work trough energy considerations[1]. In the SPC those expectations are: to evaluate processes and materials, to execute experiments, to identify error sources, to describe some of the characteristics of the scientific knowledge production and of the validation of the same one, to explain physical phenomena using the conservation laws, to study field and waves models and to describe ideas involved in physics theories developed in the XX C [2].

There are common achievements expectations in both courses. The most relevant ones are: to use models, to predict phenomena or results, to elaborate and to analyze investigative conclusions, to outline problems and temporary explanations, to formulate, analyze and compare models involved in own investigations and others, to plan research designs, to develop processes in agreement with the problem, to control variables, to select, to use and to analyze different registration, organization and communication techniques of information.

2 PHYSICS IN THE HIGH SCHOOL IN SANTA FE JURISDICTION

In HS in Santa Fe we found worrying evidences. The physics planning elaborated by the authorities of the analyzed schools and the contents developed by the professors in their classes showed important discrepancies. Also, scarce coherence exists among the lineaments proposed by the Jurisdictional Documents, in regard to the conceptual contents of physics that are recommended to develop in the HS, and what really happens in physics classes at this level [3].

We can say that it is necessary a deeper investigation about the reality of physics at this educational level, keeping in mind the formation that is expected in the students who finish HS and the capacities that they really achieve.

3 SOME DISCIPLINARY COMPETENCES DEMANDED IN IN-COMING STUDENTS TO SCIENTIFIC - TECHNOLOGICAL CAREERS IN THREE ARGENTINE UNIVERSITIES

The competences related to physics in in-coming students to the STUC in the three mentioned universities (UNNE, UNAM and UNL) were analyzed. The competences related to mathematics are almost the same ones in the three universities. However, it is worrying that the competences in physics are specified only for the in-coming students to UNNE, although this discipline is fundamental for all STUC.

We found that the competences in mathematics expected in the students are to be able: to formulate and to solve problems about operational in space geometry, to treat data and random situations, to develop different mental abilities, to observe, to describe, to argue, to interpret and to propose.

The competences in physics in the UNNE are related to identify and to apply strategies of problem-solving, to understand the relations between physics magnitudes in simple mechanics systems, to elaborate alternative procedures, to acquire reliable values of magnitudes in simple experiments, to interpret measurements properly, to approach problems about different themes skilfully and to analyze qualitatively physics situations.

4 PHYSICS IN IN-COMING STUDENTS TO THE UNIVERSITY OF NORTHEAST

In in-coming students to STUC of UNNE it was found that the knowledge acquired in the HS allowed the students to develop capacities that seem not to be pertinent to the competences enunciated for physics in this university [4], [5]. Some characteristics about physics formation during the HS in in-coming students to STUC are shown in Figure 1. The basic conceptual contents established in UNNE normative are: movement, energy, fluids, fields and waves.

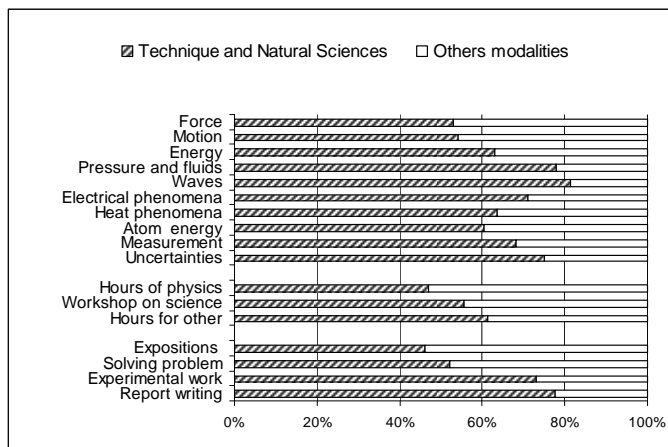


Figure 1 Physics formation in in-coming students to STUC in the UNNE.

The students were asked about the contents developed in the HS, the learning contexts and the number of hours for physics classes, Workshop on science and other activities. Also the types of activities they had developed during physics classes were investigated: expositions about concepts, problem-solving, experimental work and report writing. The number of in-coming students to UNNE coming from the modalities Technique and Natural Sciences has been grouped into one category.

It was detected that the initial capacities and abilities of the students depend on the HS modality that they have chosen. Only in Technique and Natural Sciences, the knowledge developed can be considered pertinent to the required competences. On the other hand, it is notable that the number of students coming from modalities in which physics doesn't constitute an obligatory space is relevant.

The high desertion indexes in the first years of STUC evidence serious weaknesses of the HS in regard to the formation of in-coming students to these careers.

5 CONCLUSIONS

The basic objective of HS is to get equal conditions of competences development in the students that allow them to be inserted in the world of work and to be able to continue studying at the university level. However, we found that the reality of physics at this educational level shows scarce coherence between the formation expected of the students who finish HS, and the capacities that they really achieve. Also, important differences between the competences expected in in-coming students to STUC and those ones developed by students in HS were found.

So, ¿Do students fail in the first years of the career because they have done a wrong choice? ¿Is a fourteen year old student in conditions to choose the adequate orientation of HS considering the university career he or she will develop? We think that it is necessary to intensify vocational studies in students in order to know earlier not only the profile of a profession, but also the necessary capacities, the contents involved and the kind of work they will have to do in the transition to the university performance.

Our students have developed useful tools during the HS, but we think they are not the most adequate ones to study STUC. We don't say that those students will not be able to study this kind of careers in the future; we say that the efforts they will have to do will be larger than they expect.

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