

# A new theory, a new practice.... Blackboard Physics Laboratory and assisted by free software (STEP), directed to Technologists in Systematizing of Data



**Harley J. Orjuela Ballesteros**

*Research Group Physics and Informatics Fisinfor, Faculty of Sciences and Education, Distrital University, Carrera 3 No.26 A - 40, Bogotá, Colombia.*

**E-mail:** hgorjuelab@correo.udistrital.edu.co

(Received 26 April 2010; accepted 17 May 2010)

## Abstract

The physical sciences have been, are and will be a major conceptual pillars and applications that an engineer and technologist should take their knowledge and their professional practice as it helps in the development of his thinking and in the structure of his mind, and this is where the teacher should be a guide to build along the same students with solid knowledge of a man of science, of course, from the classroom with the different tools developed, in this paper is to show an alternative method physics education in which practical and theoretical link simulated in the classroom, laboratory and computer software under free.

**Keywords:** General physics, software reviews, Computers in experimental physics.

## Resumen

Las ciencias físicas han sido, son y serán uno de los principales pilares conceptuales y aplicativos que un ingeniero y tecnólogo deben tener en su saber y en su praxis profesional, ya que contribuye en el desarrollo de su pensamiento como en la estructura de su mente, y es aquí donde el docente debe ser un guía que construya junto al mismo alumno los sólidos cimientos de un hombre de ciencia, claro esta, desde el aula de clase con las diferentes herramientas desarrolladas, en este escrito se pretende mostrar un método de educación alternativo en donde la física teórica y práctica se enlazan con simulaciones en el aula, en el laboratorio y en el ordenador bajo software libre.

**Palabras clave:** Física General, Software, Computadores y Física Experimental.

**PACS:** 01.55.+b, 01.50.hv, 07.05.-t

**ISSN 1870-9095**

## I. INTRODUCTION

The teaching of physics has had issues and views generated much controversy, because although every day we explore new tools in education as the so-called ICT (Information Technology and Communication), the experiment and epistemological contribution in the teaching of this science, it denotes the importance of such tools in secondary education and university level, more precisely in engineering, but since the technology careers such information through a question arises, how massify and strengthen the educational process at this point to keep the work done before and the work being carried posterity?

## II. THE ANALYSIS

### A. The Chalkboard.... the kind seen by the student system technology

A constructivist model (focusing on the construction of knowledge by the student). It is proposed to models of existing concepts in the student and then tested to improve, modify, or build new ones.

1. The teacher shows the concepts, introduces them, provides examples.
2. The student first learns by listening and observing different experimental models also then imitates and develops different exercises to strengthen knowledge.
3. The teacher presents and organizes a series of situations with different constraints (teaching variables in these situations), organizes the different stages Introduces them and provides examples. (action, formulation, validation and institutionalization), organizes the communication of any kind, proposes at the right time conventional elements knowledge (notations, terminology).
4. The student tested, seek, propose solutions, confronted with those of their peers, defend their positions and argue the results.

## B. Conflict Management class academic

While all kinds of sciences, physics in this case, there are conflicts in the learning of a concept or handling a mathematical exercise, as well as in the development of laboratory experiments, the handling of such conflicts are resolved mostly in groups, i.e. in the development of the master class, where other students help in the advancement and understanding of the issue raised, with examples and exercises conceptual distressing, however, if this problem is not resolved in that way Professor assesses practitioner performed after the class which seeks to resolve any questions that arise

## C. The Chalkboard... the kind seen by the student system technology

The Distrital University Francisco Jose de Caldas has excelled in the academic national and international quality training of professionals in its various undergraduate and graduate, but thanks to the revolution in education (to call them that), has generated a great impact on the training of technologists and the massification of education, providing academic opportunities to a population that yearns for a future professional projection and the most important quality.

However, prospective students and technologists (some future engineers) have a more proactive in acquiring scientific knowledge, higher-level knowledge, knowledge that self-awareness, will be required for their careers and professional.



FIGURE 1. Students at the XIV technological weeks.

But how they perceive the class ?..... students are very perceptive in the attitude of the teacher at the time of his chair, and in this particular case the teacher practitioner, but not only his attitude to the chair by itself or his mastery of the subject, also consider the called the blackboard, this domain being vital for the understanding of the theme, (THE PHYSICS), but the board should not be a device which is (copy and paste) the readings of the books, the equations to

solve or needs to be done, it is essential to generate the questions that led to answers as a starting point in solving practical problems and physical systems, students cooperate in the inspection and search results to the questions generated by the board that while has been the tool by excellence in teaching, can be enhanced by epistemological and historical aspects that feed the teaching of the lecture .... The classroom or auditorium, see figure 1

## D. The Experiment... A large motivation Student

Once the lecture focused and carried out the reinforcement on the board, the student has struck, he can be physical, and this will only denoted in the laboratory, but not in the classic laboratory development and thus is reference laboratories for general use, to achieve a real application the student sample and generates its own elements of measurement, in this case the construction of the assembly as a whole, in the case of classical mechanics by asking the student to design a mobile wood which will summarize all the concepts and apply appropriate lectures and laboratories predecessors, these concepts are as set forth in abut issues classical kinematics and dynamics.

The method to be followed in the construction of knowledge throughout the experiment are, see figure 1:

1. Mount Construction.
2. Taking Action.
3. Discussion of results.



FIGURE 2. a. The laboratory Construction, b. taking measurements, c. Discussion.

## E. ICT's as a tool in teaching physics

As noted by Lic Aries M. Cañellas Cabrera in his article (Impacto de las TIC en la educación: un acercamiento desde el punto de vista de las funciones de la educación), "Interactivity, which is one of the features that allow you to acquire a full sense in the field of training, and allows interaction subject - machinery and adapting it to educational and cognitive characteristics of the person. Facilitating this way that subjects are not merely passive

recipients of information but active processors and aware of it."[1]

Students reinforce the knowledge learned from the board and his experience in interactive media complement theoretical and practical aspects in the completion of the course.

But the phenomenon of ICT becomes more complex when applied new technologies to education, since its influence in this respect (though not the only one it is which gives more power) goes beyond its potential for learning and training [2].

This latest tool reinforces the matters discussed in lectures and practical lessons learned in the pilot, the only difference lies in the individuality that it generates in the student, i.e., the first steps in learning is given in the group work (lecture and experiment), but the latter tool searches the acquisition and final construction of knowledge.

**F. The free software (Step) applied to the completion of the teaching - learning process**

STEP, More Than a Physical Simulator is an educational tool in teaching physics, but with some details that enhance its educational role, the most important you can highlight the fact that free software, besides being open source (open source), which partially or completely modify its source code. The simulations developed in this educational software focuses on theoretical aspects of physics, mainly in Physics Mechanics, Electrostatics, Thermodynamics and Molecular Dynamics [3, 4].

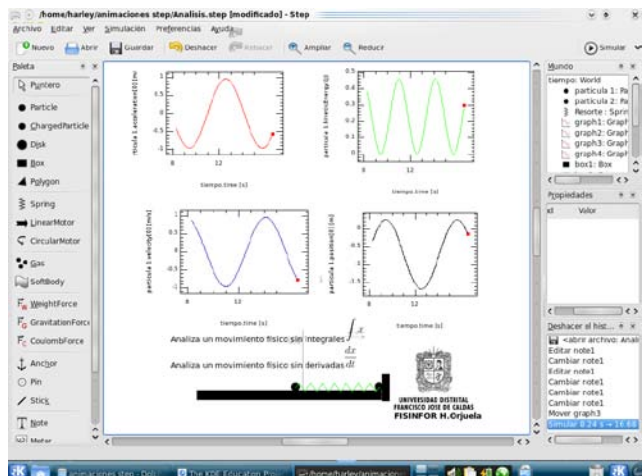


FIGURE 3. Simulation developed by students, taken from (STEP). <http://proyectostep.tk>.

For laboratory practices developed by the students is emphasized in classical mechanics uniform accelerated motion and without acceleration, in addition to this is emphasized in the Newtonian dynamics as seen in Figures 3 y 4:

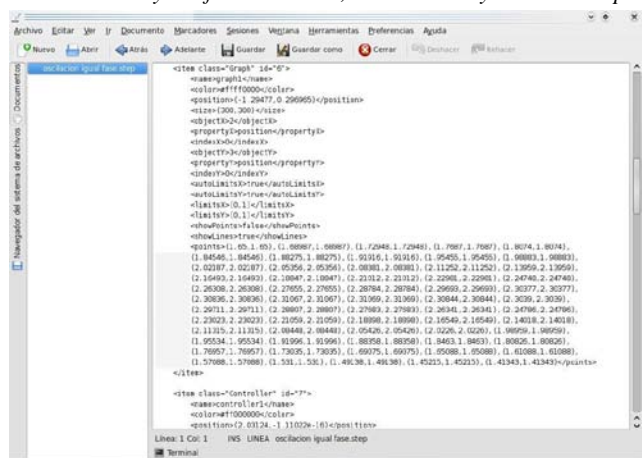


FIGURE 4. Source code of the simulation developed by students in which students analyze the motion of a harmonic oscillator.

**III. CONCLUSIONS**

The most suitable in relation to teaching and education is concerned is the successful deployment of the tools you have, because the tools themselves cannot accomplish the work of education, i.e., the laboratory more accurate, more perfect simulation, the more consistent mathematical development or historical and epistemological development can foster more accurate or direct the student to learn lines, and even more, knowing a student's level of technology, which is the product of a process which culminated in the development of his professional practice as a technologist and engineer, plus professional feedback, teacher in charge. The role of the teacher who devotes her life to questioning can foster the student newspaper with their work in class as the teacher showed us Stephen Hawking in one of his greatest works: The world has changed more in the last hundred years than in any previous century. The reason for this were not the new political and economic doctrines, but the great developments sponsored by the progress in basic science [5].

**REFERENCES**

[1] Aries M., *Impacto de las TIC en la educación: un acercamiento desde el punto de vista de las funciones de la educación* (Revista de Nuevas Tecnologías y Sociedad Cañellas Cabrera, No. 43, ISSN 1575-9393, 2006).  
 [2] Cabero, J. et al., *Impacto de las TIC en la educación: un acercamiento desde el punto de vista de las funciones de la educación* (Revista de Nuevas Tecnologías y Sociedad Cañellas Cabrera, No. 43, ISSN 1575-9393, 2006).  
 [3] Orjuela B., Harley. et al., *Desarrollo De Step, Un Nuevo Simulador Interactivo, Como Una Propuesta Alternativa En El Perfeccionamiento De Herramientas En La Enseñanza De La Física*. (Memorias Simposio Centroamericano y del Caribe de Física XXVIII CURCCAF. San José, Costa Rica, 2009).

*Harley J. Orjuela Ballesteros*

[4] Orjuela B., Harley *et al.*, *Curva de Bowditch de un sistema de dos osciladores Simétricos, analizado y modelado bajo interfaz gráfica libre*, (Memorias Simposio Centroamericano y del Caribe de Física XXVIII CURCCAF. San José, Costa Rica, 2009).

[5] Hawking, S., *On The Shoulders of Giants* (Running Press, New York, 2002).