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ComPhySport Physics-Sport Complex

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Abstract
The development of new information and communications technologies (ICT) provides schools with new teaching and learning tools.
The integration of new technologies and new teaching methods presents a range of competitive advantages for students, for it allows an improvement of the learning process in each phase of education.
The following article presents a project (ComPhySport) and a website which applies the concepts of Physics to the subject of Physical Education (PE), in them; the students are given the opportunity to observe the direct connection between both subjects on a daily basis.
Key words- Physics, Education, learning, Physical Education (PE), Information and Communications Technology (ICT)

1. Rationale for the Project
Physics provides the foundations to understand economic and technological development featuring current society and thus to enrich both formal and personal education. Moreover, Physics allows us to understand scientific work and to bring students closer to scientific methodology so that the students may become enabled to make contributions using their own criteria when approaching important current affairs such as energy, climate change, recycling and so forth.
Over the last few years, it has been shown that students present difficulties in assimilating basic Physics concepts due to the fact that, in most cases, such concepts are limited to theoretical explanations in the classroom and their application to daily life has remained so far occasional. To this it must be added the use of scientific language and mathematic complexity, which promotes a perception of Physics as a complex discipline detached from reality leading to lack of motivation for its study [4]. On such grounds, more and more teachers have searched for new tools that may be used in the classroom to motivate students by helping them to assimilate basic Physics concepts [1].
In sharp contrast to Physics, Physical Education [2], is an appealing subject for students for it mainly takes place outside the classroom and students, regardless their sporting skills, can acquire curricular main competences in different ways [3].
This project intends that students of Year Five of Primary Education and Year Twelve (GCE) acquire basic competences in Physics by seeing its applications in sports and Physical Education so that the gap between the contexts of abstract Physics and students' daily lives can be eventually bridged.

2. Objectives
The main objective of this project is ***to improve the students' learning of Physics through sports.***
Secondary objectives are listed below:

- To acquire curricular basic competences in the subjects of Physics and Physical Education
- To show the applications of Physics to daily life in the context of sports
- To favour the development of physical activities
- To promote knowledge and understanding of Science, Information and Communications Technology as well as of physical activity.
- To assess the use of ICT in the teaching of both Physics and Physical Education.

3. Monitoring and Assessment
Assessment is one of the elements of the teaching-learning process. It does not merely consist of giving the student a mark according to a given assignment or exam but rather, it values the totality of the learning process. In this way, conclusions on the teaching process can be drawn, allowing the teacher to modify and make improvements in the methodology at work. Moreover, drawing attention to the factors that condition learning and productivity allows better understanding of assessment for each student. In order to carry out the evaluation process, a number of tools are provided according the

sports and Physics concepts that are being developed. Such tools are meant to transcend mere oral and written tests. In addition, this project makes use of further evaluation tools, which may hold more weight than traditional ones, such as rubrics, production of videos and multimedia presentations, article commentary tournaments and sport or scientific competitions. At the end of each unit being developed, it will be necessary to carry out a series of statistics to measure the students' progress and areas for improvement.

4. Methodology

One of this project's secondary objectives is the assessment of ICT applied to the subjects of Physics and Physical Education. In order to do so, a website will be developed as shown in figure 7. Moreover, it will be necessary to prepare the sceneries or grounds for different sports. Whenever developing information sheet or exercise in the centre's premises (see figures 1 and 2) is not possible, teachers shall arrange trips to other sport centres in the city in order to carry out the activity. The same happens with tools designated to each activity such as rackets, balls, chronometer, dynamometer, strings amongst others.

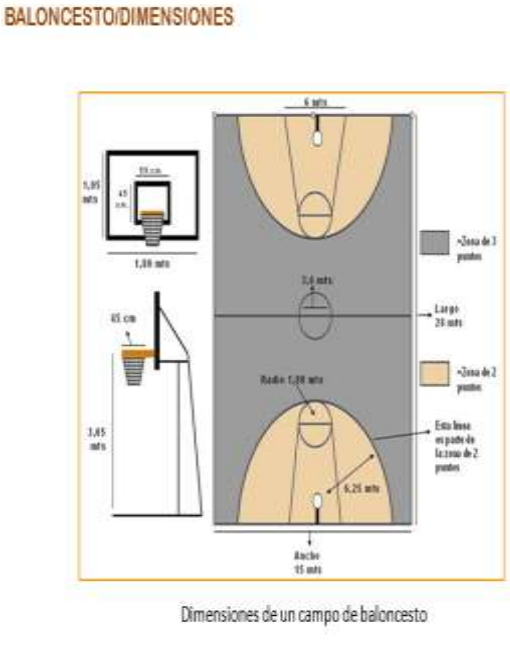

Figure1. Basketball information sheet.

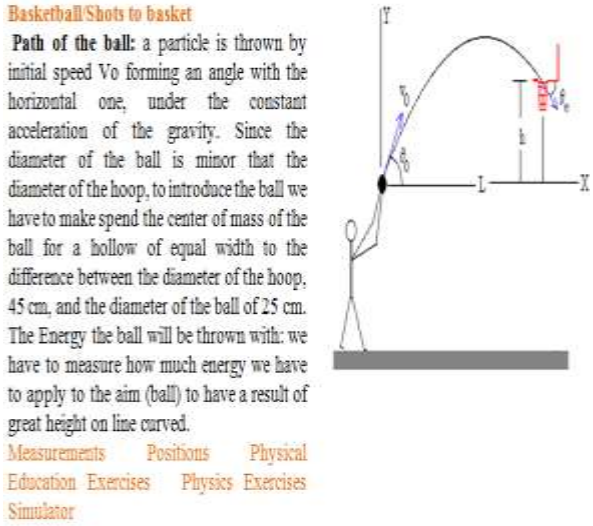

Figure2. Basketball information sheet and parabolic motion

The sports set for practice in this project consist of ball games that are most widely practised today though the project can be expanded to other sports such as swimming, tennis and running as Physics Laws are to be observed in all of them. See listed below the principles, concepts and Physics theories that apply to the aforementioned sports within the established curriculum for years five and twelve.

Swimming

- Archimedes' Principle
- Newton's Third Law, action-reaction.
- Inertia. Levers. Bernuouilli's Principle.
- Buoyancy Force.
- Speed Square Law. Acceleration.

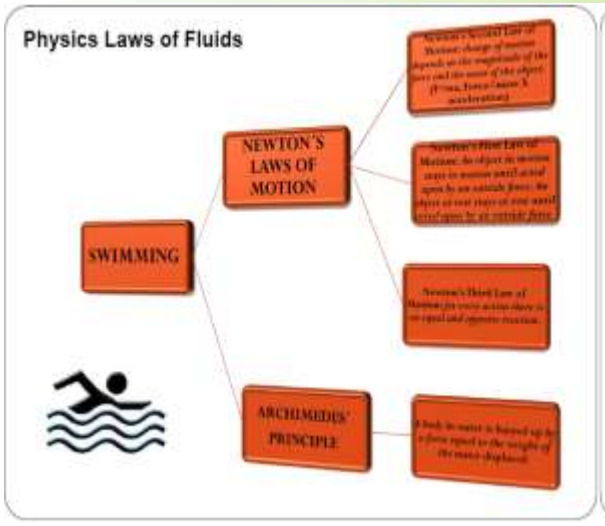

Figure 3. Physics concepts applied to swimming.

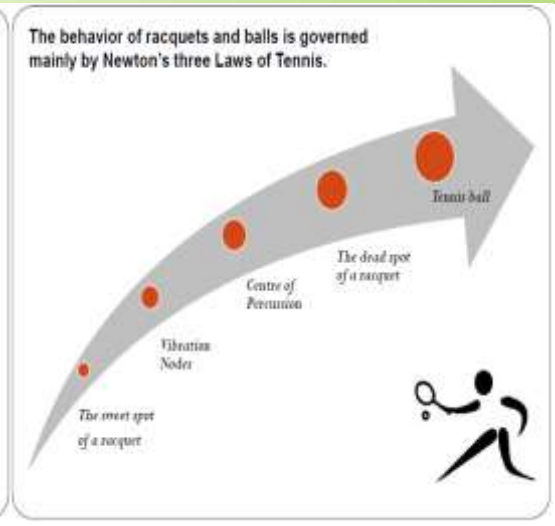

Figure 4. Physics and Tennis.

Tennis

- Energy Conservation
- Principle of Action-Reaction
- Work and Power
- Lineal movement
- Force of Inertia

Athletics

- Work
- Conservation of potential/cinetic/ gravitational potential energy
- Angular Moment
- Lineal Moment
- Newton's Laws

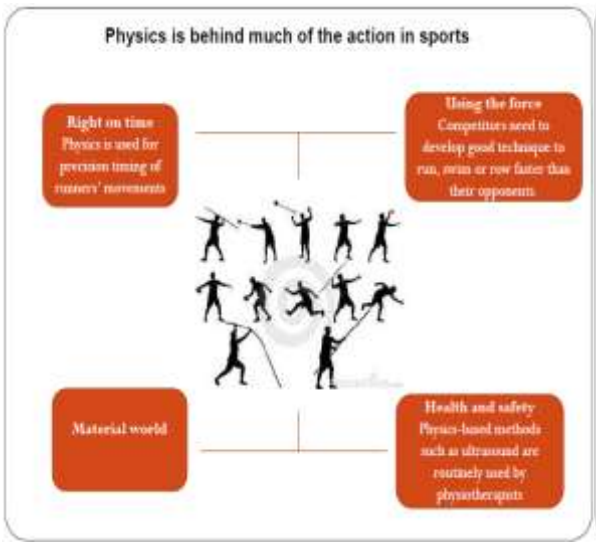

Figure5. Physics concepts applied to athletics.

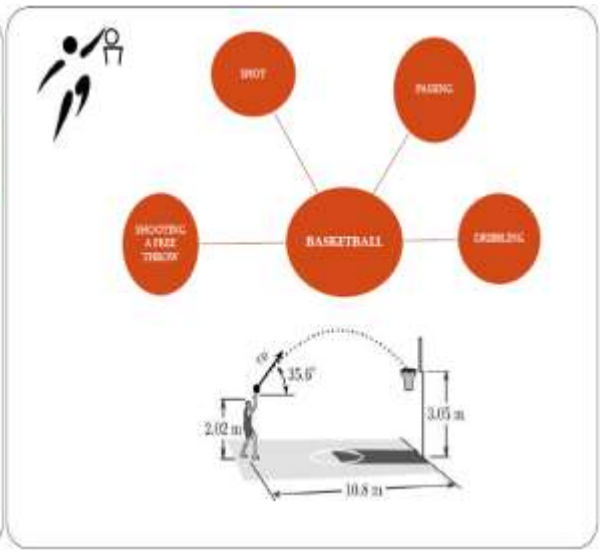

Figure6. Physics and Basketball.

Basketball

- Newton's Laws. Mechanics of Motion

- Horizontal, oblique and parabolic movement. Work-
- Gravitational centre of a rigid solid.

Over the school year, the web contents will be updated according to progress made in the subjects of Physics and Physical Education by students in both years. Each teacher will make a presentation of the relevant didactic unit to be added to the website. The presentation will include the concepts to be developed, both for Physics and Physical Education), competences and standards to be eventually evaluated.
In each section dealing with the different sports (football, basketball, volleyball), the student will find a series of information sheets with technical explanations (figures 1 and 2) which shall include:

- An outline with the Physics theories and principles at work in each sport.
- Videos and presentations with conceptual explanations.
- Exercises to be carried out in Physical Education and Physics according to curricular establishments.
- Reinforcement and extension exercises.
- Standards to be evaluated.

There will be an administrator for the application who will register each user. Each student and teacher will have a user's account in the web so that they can update its contents and sent the score for completed exercises to be evaluated. Similarly, discussion forums will be proposed in order to deal with topics of relevance to the development of didactic units such as articles or films.

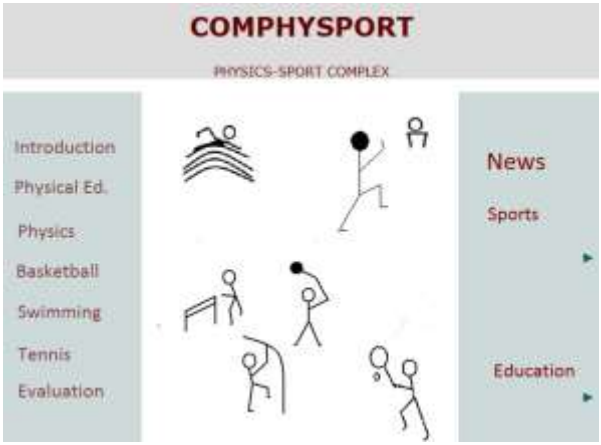

Figure7. Project Web.

Resources used for this project may include the following:

- Text books.
- Films, videos and multimedia presentations.
- A Project Web which meets accessibility standards.
- Required tools for the practice of sports in the Physical Education lesson.
- Statistical tools designated to the evaluation of students.
- Articles.

5. Result Assessment

This project aims at improving academic results for students of fifth and twelfth year in the subject of Physics as well as the students' physical productivity in sports competition. In order to do so, teachers of both disciplines must work together so that the program can be fulfilled and students can be somehow more motivated. A main objective is pursued, namely, to improve the students' productivity in the subject of Physics and Physical education by establishing connections between the classroom and daily life. By following this line of work in the classroom and expanding the bank of resources with images from other contexts, we intend to elaborate an application which allows to approach the subject in a way that can improve the students' motivation as well as their analytical skills at work as they process the information that they receive in their daily lives.

6. Future Lines of Work

Initially, we intend to develop this project by using those ball sports that are included in the school curriculum although it is surely noteworthy that the wide range of uses of Physics principles may also be applied to other sports such as cycling, horse-riding or archery. In the future, this learning strategy may be applied to further disciplines and even university courses as well as to primary education, whose curriculum includes the subject of Environmental Studies with concepts in Physics at a different level.

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