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**SCIENTIFIC ARTICLE (ENGLISH)**

**TOPIC:**

**DEVELOPMENT OF A WEB APPLICATION FOR LEARNING KINEMATICS WITH 3D  
ANIMATIONS, USING THE DESED METHODOLOGY.**

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# Development of a web application for learning kinematics with 3D animations, using the DESED methodology

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**Summary.** *This research aims to design a web application for learning kinematics using 3D animations, providing students and teachers teaching-learning tools by supporting 3D animations that provide quality, dynamism, and allow better understanding of how abstract concepts, this web application was created using the DESED methodology.*

*Each of the 3D animations were evaluated by experts in the field of physics, in order to approach key points learning kinematics.*

*One of the goals set was to use free tools, for which Blender was used for the production of 3D animations and Educaplay to generate assessment structures.*

## Keywords

3D Animation, DESED Methodology, Web application, Kinematics, Blender.

**Abstract.** *This research aims to design a web application for learning kinematics using 3D animations, providing students and teachers teaching-learning tools by supporting 3D animations that provide quality, dynamism, and allow better understanding of how abstract concepts, this web application was created using the DESED methodology.*

*Each of the 3D animations were evaluated by experts in the field of physics, in order to approach key points learning kinematics.*

*One of the goals set was to use free tools, for which Blender was used for the production of 3D animations and Educaplay to generate assessment structures.*

**Resumen.** *La presente investigación tiene por objetivo diseñar una aplicación web para el aprendizaje de la*

*cinemática mediante el uso de animaciones 3D<sup>1</sup>, proporcionando a los estudiantes y docentes herramientas de enseñanza-aprendizaje mediante el apoyo de animaciones 3D que aporten calidad, dinamismo, y permitan comprender de mejor manera conceptos abstractos, esta aplicación web fue creada empleando la metodología DESED<sup>2</sup>.*

*Cada una de las animaciones 3D fueron evaluadas por expertos en el área de física, con el fin de abordar puntos clave para el aprendizaje de la cinemática.*

*Uno de los objetivos planteados fue el uso de herramientas libres, por lo cual se utilizó Blender para la producción de las animaciones 3D, y Educaplay para generar las estructuras de evaluación.*

## Palabras Claves

Animación 3D, Metodología DESED, aplicación Web, Cinemática, Blender

## 1. Introduction

Kinematics is a branch of science that studies Physical movement of bodies, without regard to the strength produces them. In this context arises as a subject that requires more time, concentration and analysis for their learning.

Today students are familiar receive visual and auditory encouragement that capture your attention. Animations can project three-dimensional motion graphics linked with audio and video making abstract concepts of physics assimilate more naturally.

<sup>1</sup> 3D: three-dimensional computation, the three dimensions are length, width and depth of an image

<sup>2</sup> DESED: Methodology for the Development of Educational Software

"Internet is creating options for interactive education the students, will cover a wide domain of issues through research.

For years teachers have sought ways to increase the teaching experience of its students, Internet provides the path to that experience, contributing a bit to achieve better results in education."(Linares, P. M, 2009)

"The educational use of digital media such as 3D animations aims to enrich and diversify the content so that more attractive and closer to the reality of students, through half motivates them and fascinates them." (Creus, Amalia, and Sánchez.

"The use of technology enables the simulation of physical phenomena in 3D, so that students will withhold more information by understanding audiovisual media animations and sounder stand them better." (Ferro Soto, Carlos Martinez Senra, 2009)

Students need a different option in acquiring knowledge, this can be achieved by the web application, which adds the richness of 3D animations and achieve attract more attention from teenagers, learning will be much faster and interactive, besides it has plenty of activities for self-assessment of knowledge. Educaplay can add a feedback, which will be displayed once it has corrected the question, by way of explanation, which ultimately facilitate learning from mistakes, allowing know just when they occur.

"When the teacher's teaching style is dissonant with respect to most learning styles of students in a given class, they may feel discouraged and frustrated.

It is clear that academic achievement is related to the learning process. Students learn best when using the style that is most comfortable. To the extent that our teaching method can accommodate the preferences of student learning, the number of students who will succeed will be greater."(Martin, G. M, 2010)

The web application has a catalog of 21 3D animations, grouped into 5 modules about topics of kinematic branch of physics, with a structure organized by topic and subtopic.

## 2. Materials and methods

### 2.1 Materials

Free software tools used to implement the web application. The CMS Joomla3.2.3 allowed us to create a dynamic web site with a friendly user interface. This content management data base requires for its operation for which usó MySQL5.1. While Apache2.2.16 was used as a webserver.

To produce 3D animations of two platform Blender2.71 was used, among its main features can mention that offers a wide range of essential tools for creating 3D content, including modelling, UV mapping, texturing,

rigging, skinning, animation, simulation particle, scripting, rendering, compositing, post-production and creation of videogames.

Besides Blender, Google SketchUp was used for the preparation of certain architectural models which were imported Collard a format (\* .dae) Blender, showing that these tools can be integrated easily.

As regards Google SketchUp can benoted that allows you to create complex 3D designs easily, the program includes a gallery of objects, textures and images ready for download.

For recording voice of the main character Galileo Galilei, was necessary to obtain the proper equipment, a microphone which reduced noise and ambient echo. The program used for editing the audio was Audacity2.0, whereby the audio is easily manipulated, and some sound effects are included, such as noise reduction, change the pitch and speed of the voice, among others.

### 2.2 Methodology

For the development of the web application studying DESED methodology was performed, which allows the creation of appropriate educational software, methodology takes into account both aspects of software engineering, education, teaching and graphic design, achieving obtain a software quality.

"Methodology allows the creation of products for creative software, but go hand in hand with the position of a subject, teaching method and are tailored to a user with specific characteristics, DESED includes 13 key steps grouped into 4 phases." (Peláez, 2006)

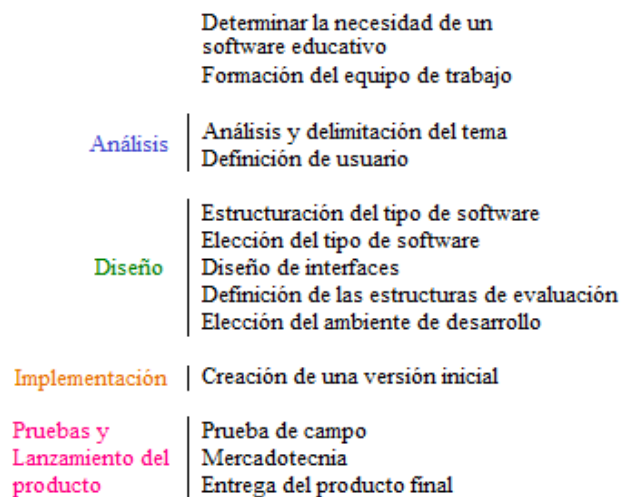


Figure 1. Phases- Methodology DESED  
Source: (Peláez, 2006)

Before the development methodology is necessary to establish the importance of creating educational software. Students have high rates of failure and discouragement to the subject of Physics, young people are used to getting visual and auditory stimuli at an exhibition class find it boring.

That is why it is necessary to include a learning resource which provide greater interactivity and facilitate the interest of students to wards learning kinematics.

Another fundamental points with in the methodology is the creation of the team, you need to have the support of specialist software development, expert teachers in the area, in Table 1 the responsibilities of each member in the working group.

Professional	Activities
Pedagogue	Create learning models for the Physical area specifically for cinematic theme.
Teacher	Check and analyze the applicability of learning models proposed by the teacher. Define the contents to be discussed.
Software developer	Turn ideas from teacher to teacher and digital visual media (web application), with a friendly user interface.
Graphic Designer	Designing the website, make a proper selection of colors.

Table 1. Activities in the professional profile.  
Source: Own.

For the analysis phase content is established and the specific aims of each subject are determined, it is noteworthy that took into account the curriculum guidelines for the “Bachillerato General Unificado”: Department of Physics defined by the Ministry of Education.

In this phase is necessary to define the characteristics required the user to interact properly with the Web application.

Define user	
Profile	Course: 4th BGU, 6th BGU Sex Male / Female Age: 15 to 18 years Spanish Language Disabilities or impairments: No usable for teenagers with physical or mental disabilities
Computer experience	Low, novice user

Table 2. Defining user.  
Source: Own.

In the design phase the type of educational software is selected, the algorithmic type of tutorial mode is adopted, because it is the most suitable for teaching curriculum content, as it is responsible for instructing the student theoretical information, and then evaluates the knowledge acquired through different activities.

Another important aspect of this phase is the design of the interface as well as influencing the acceptance of the software, the student may result in a rejection of the subject

matter. Therefore use a simple interface that is intuitive and allow the user to navigate easily designed.

To define assessment structures Educaplay free computing platform, characterized by its attractive and professional results was chosen. Educaplay generates up to 14 different types of activities, those used in the web application were: Test, interactive map, complete, riddle, crossword, word search and arrange words.



Figure 2. Evaluation Riddle type.  
Source: Own.

Regarding the development environment Blender was used for the creation of 3D animations Audacity for audio editing and Joomla to create the Web application.

In the implementation phase program proceeds to the designs defined in the design phase.

The last phase corresponds to testing and product launch, after applying a poll even group of students and teachers of the "Alfredo Galindo Albuja" Education Unit in Ibarra city regarding the acceptability of the Web application, the biggest drawback presented was time to load the videos, to solve this problem it was decided to host the videos in the audio-visual platform YouTube, then made some changes to the interface, we proceeded with the spread of the web application in major social networks (Facebook, Twitter and Google+), and concluded with the delivery of the final product.

### 3. Results

Once executed the respective improvements to the application, and some of the same functional screens are presented. It should be noted that the web application has a responsive design, able to adapt to different devices, both desktop and mobile.

The comments received from users have been positive showing a product acceptance and stressing that has been very useful in the learning process of this subject.

The web application was connected with the Google Analytics tool, which provides information about traffic a website, through this tool was possible to determine the exact number of users connected to the web during the period 26 February 2015 to 28 r March 2015 rises to 2,958, with an average session length of 05:40 min, web application

also has not only had an impact on Ecuador but has transcended different countries, among which are: Mexico, Venezuela, Colombia, Peru, Spain, Argentina, among others, from which it can be concluded that its acceptance that has taken the web application has been favourable.

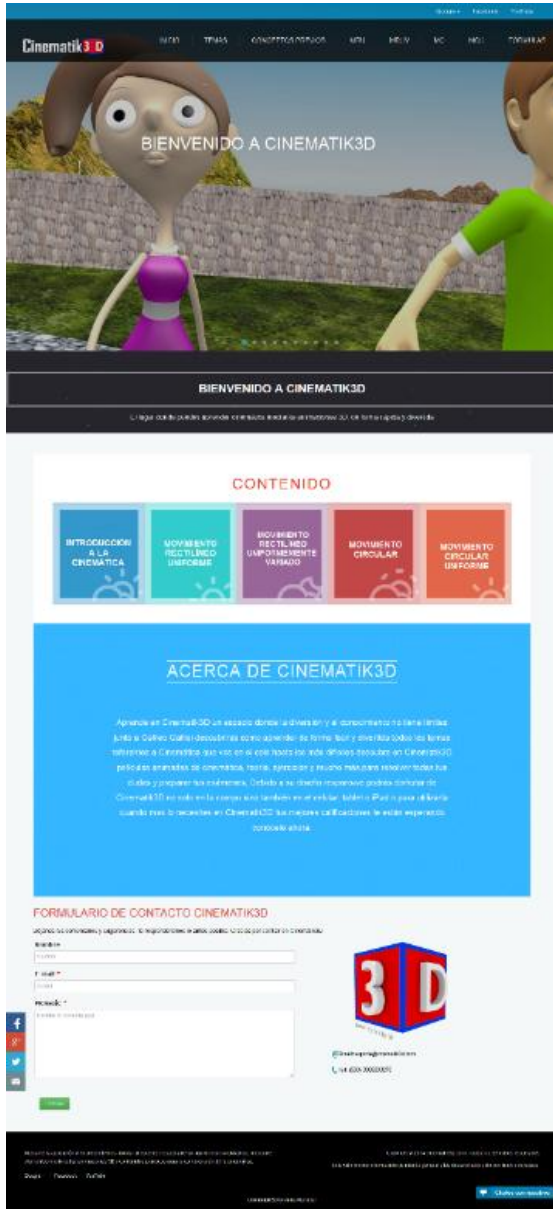


Figure 3. Homepage  
Source: Own.

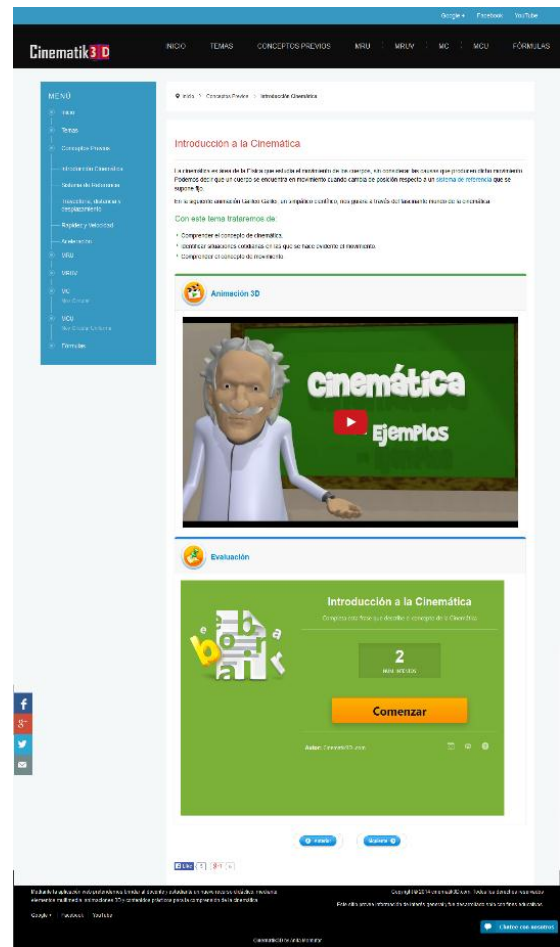


Figure 4. Page theme Introduction to Kinematics  
Source: Own.

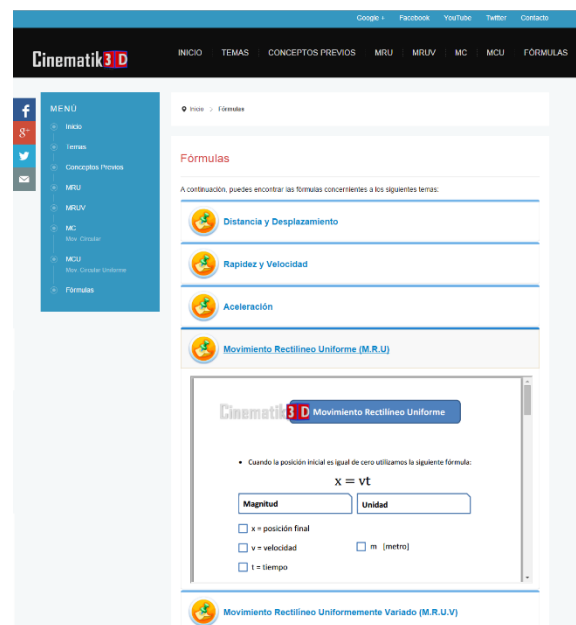


Figure 5. Page Form  
Source: Own.



## 4. Conclusions

Currently the use of 3D technology is revolutionizing the world of education, Blender has the skills to carry out the entire process of producing three-dimensional animations and create educational materials attractive features.

The use of free software tools can significantly reduce the cost of implementing this project, without losing the quality of the product, also due to the use of free tools is possible to release the application under the Creative Commons (CC BY-NC-SA 4.0) under the following conditions, giving credit to the author, do not use it for commercial purposes and Share Alike license.

The implementation of the application using the methodology proposes several phases which are carefully detailed, covering all the elements necessary to obtain a high quality product taking into account both technological and educational aspects.

After running the pilot, and make the tabulation of surveys of students and teachers it was found that the Web application provides the tools to contribute to teaching and learning in the field of kinematic features in addition that while the test is performed pilot interest and enthusiasm from the students was found while interacting with the Web application.

The selection by teachers for quality materials is key success of the learning process. Through the web application provide teachers a new teaching resource that uses technology to capture the attention and motivation of the student both inside and outside the classroom.

In order to measure the degree of acceptance of the application web survey was applied to a group of 10 students and 2 teachers of Physics, chosen at random from the "Alfredo Galindo Albuja" Educational Unit located in Ibarra city below is a table with the results:

Results of the survey of students	
Pedagogical aspects	91,86
Presentation of Information	93,79
Technological Aspects	93,14

Table 3. The Results of the survey students.  
Source: Own.

Results of the survey of teachers	
Pedagogical aspects	93,57
Presentation of Information	94,64
Technological Aspects	95,71

Table 4. The Results of the survey teachers.  
Source: Own.

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