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## Tutorial 2.0 on Technical Drawing 3D and Visualization

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### Abstract

This article shows the experience of applying technologies based on web 2.0 in an environment of learning at university level. Students are more and more familiar with such tools and learning at the University should be sensitive to this evolution. This tutorial 2.0 is based on two virtual environments that support and improve communication in the teaching-learning process: Moodle as an "institutional adapted" platform, and Site Google as an open platform. The temporary planning has been done with the design of a timeline. The implementation of the tutorial 2.0 has been highly accepted by the students. With respect to the teaching staff, they need permanent updates and the adaptation of web 2.0 tools in the development of the subject's guide.

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### 1. Introduction

In recent years, the continuous incorporation of new technologies in the learning process has been an important factor in the educational process [1]. The Technical University of Madrid (UPM) promotes educational innovation processes and develops projects related to the improvement of the education quality.

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The experience that we present fits into the Educational Innovation Project (EIP) of the E.U. of Agricultural Engineering of Madrid. One of the main objectives of the EIP is to "Take advantage of the new opportunities offered by the Learning and Knowledge Technologies in order to enrich the educational processes and teaching management" [2].

Our research group Geovisualization of Special Areas and Heritage (GESyP) works to progress in the introduction of the knowledge and skills specific to the Technical Drawing and Display with accessible electronic formats, in order to facilitate the acquisition of general and specific skills [3].

The subject of Technical Drawing 3D and Visualization (Rg3V) has a workload of 4 ECTS (European Credit Transfer and Accumulation System). This area is part of the specific technology module for Horticulture, Gardening and Landscaping. It responds to the professional and occupational profile of the Cartographic Engineering, Geodesics and Photogrammetry in the scope of its application to agricultural engineering. It is mandatory and is included in the UPM Program (2010) for the Degree of Agricultural Engineering (DAE) by the UPM, see Fig 1.

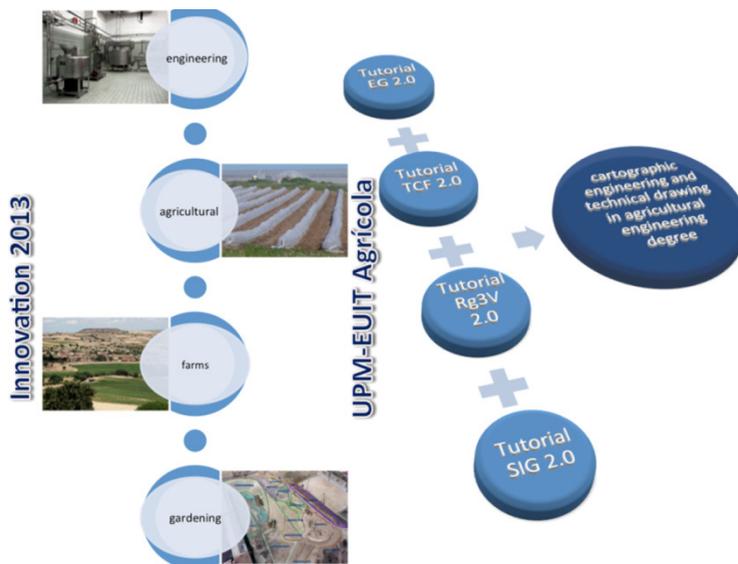


Fig. 1. Formative Rg3V context of the tutorial 2.0

The Tutorial 2.0 objectives are as follows:

- To encourage the student to study and apply the Rg3V in the area of agricultural engineering.
- To integrate the student's Rg3V training and evaluation in cross-disciplinary skills, by introducing active learning techniques in order to develop and evaluate generic and specific competences.
- To guide the student in the area of Cartographic Engineering, Geodesy and Photogrammetry, as well as its close relationship with Science and Related Techniques for its potential development and application in this engineering area.
- To design an interactive graphic material that can support teaching Rg3V subject, as well as self-learning in the virtual platform Moodle and other educational virtual environments 2.0 [4].

Therefore, we have a tool that aims to promote actively teaching and learning, and where the student is a motivated player. With respect to the teachers, they require permanent updating and time for the coordination of the training action [5].

## 2. Methodology

There has been a prior analysis of the acquisition of similar skills in other subjects offered by UPM and other universities. Further to the selection of the content for the tutorial, new resources and teaching materials have been developed.

For educational planning of the subject of Rg3V and as part of the tutorial 2.0, the resource of the Timeline (LT), generated with the Dipity Software, has been used (see Fig. 2). This tool allows to sort a sequence of events on the subject, in order to clearly display the temporal relationship between them. It also adds and links intuitively interactive content that serves to guide the student. This aims to improve the teaching-learning process [6].



Fig. 2. Timeline of the tutorial 2.0

The "reverse engineering" is to obtain information or a design from a product accessible to the public, in order to determine of what is made, what makes it work and how it was made. The cycle of this process is: construction - final design - basic design - pre-design. Based on this cycle, characteristic examples of each of the three thematic units (UT) that contains the subject Rg3V (and therefore the 2.0 Tutorial) have been represented graphically. These examples are designed in 3D computer graphics, animated, accessible and can be manipulated.



Fig. 3. Virtual model 3D and image

The environment of Augmented Reality (AR) has been used to incorporate virtual information into the existing physical information. The student interacts with physical objects; the computer projects additional information about them and also captures the relative to the environment. As markers has been used open source Quick Response code (QR) (Fig 3).

It has been generated content in the area of the Aurasma software. This software uses an advanced technology of image recognition on which is superimposed multimedia elements: graphics, symbols, images, animations, video, 3D models and hyperlinks.

### 3. Results

The Tutorial 2.0 on Technical Drawing 3D and Visualization presented here includes a set of training resources that have the aim of helping and complementing this matter [7]. We have used two virtual environments that serve as communication and support for the process of teaching-learning, Moodle as a platform "institutional adapted" and Site Google as an open platform [8].

With these elements and scenarios 2.0, the students are able to acquire the three learning outcomes corresponding to the three thematic units of the subject Rg3V: Modeling, digital models of terrain (MDT) and Geovisualization.



Fig. 4. Rg3V learning guide

#### 4. Conclusions

Ultimately, this tutorial Rg3V helps learning outcomes described in the teacher guide for this subject to be acquired through collaborative learning procedures that evolve continuously in environment 2.0 [9]. Therefore, to be added to the Personal Learning Environment (PLE) of each participant they endure over time.

We have seen the potential benefits derived from the effective use of the tutorial 2.0 for a majority of students. To collaborate and to share, help to overcome the difficulties of the learning process.

A problem that we have found is the level of acceptance of this technology 2.0 in some students. Therefore, the starting point to achieve the expected learning outcomes is quite different.

On the other hand, the implementation of this tutorial demands the teachers a permanent effort to be updated on specific technologies.

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