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MATHEMATICS FOR ECONOMICS AND BUSINESS ADMINISTRATION AND PROJECT-BASED LEARNING

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Abstract

In subjects like Mathematics for Economics and Business Administration there are not many innovations in teaching to promote the use of new active teaching methodologies. In this paper, we justify the use of the methodology of project-based learning using new technologies to develop general and specific skills associated with a significant part of this course, the economic applications of Mathematics. This methodology allows the teacher to assume the role of guide in student learning process and develop quality teaching to motivate and involve students in the teaching-learning process as an active part of this. It also allows the development of general skills associated with the studies of Economics and Business and specific skills associated with Mathematics applications. We describe the adaptation of the methodology to achieve these objectives based on the characteristics of the subject.

Keywords: New methodologies, Project-based learning, Mathematics, Economics.

1 INTRODUCTION

Nowadays, education faces two important challenges: students assuming the control of the learning process which must be guided by teacher and developing the necessary abilities for their future employment which up to now had not been considered in the teaching of most subjects.

This involves their redefinition of teaching subjects, in our case the Mathematics for Economics and Business Administration. In their planning it is very important the practice, which must include studying and analyzing of those simple economic applications related to the basic mathematical concepts. The little interest of students to this subject in the studies of Economics and Business is caused by the difficulty of it and ignorance of the necessity and usefulness of Mathematics in the study of several economic phenomena. The economic applications are useful to show the importance of Mathematics in this kind of studies and can be used to motivate students towards the subject and making them play a leading role in the learning process. In addition, the teaching of these applications acquires greater relevance now due to favoring the development of generic competences such as the capacity for applying knowledge in practice and the capacity for analysis and synthesis.

For this reason we believe it is necessary to search for new teaching methodologies to teach the Applications of Mathematics in Economics and Business which allow the development of generic competences, assigning at the same time students a leading role and the teacher the guiding role of the process.

Nowadays, it is used ways of teaching-learning which let us face these challenges, the project-based learning on the Internet among them. This didactic methodology is characterized by the development of learning processes and the construction of knowledge through the information obtained from the Internet. It is used by WebQuest, MiniQuest and Treasure Hunt.

In this paper it is exposed an activity created from the profile and structure of WebQuest and Treasure Hunt to the teaching-learning of Mathematical Applications for Economics and Business.

2 MATHEMATICS FOR ECONOMICS AND BUSINESS. THE ECONOMICAL APPLICATION OF MATHEMATICS

Mathematical training of a professional in Economics and Business must allow him to understand the basic models of modern Economics and the techniques used in the business management. The Mathematics subjects in Degrees of Economics, Business Administration and Finances and

Accounting let the student understand other subjects based on logical-mathematical premises such as Economical Theory, Statistics or Econometrics.

The subject of Mathematics for Economics and Business studies techniques and instruments that help quantifying and solving specific problems of economical and business analysis. The teaching of quantitative techniques must include the setting out and solving of mathematical problems. The practical part in this discipline is essential to show the importance and need of Mathematics in the study and analysis of many economical phenomenons and so, the practical exercises must start from an economical content.

The Economics Applications of Mathematics link mathematical contents with economical ones and prove in obvious ways their utility, stirring the student's interest towards the subject and motivating them towards its learning.

3 MATHEMATICS FOR ECONOMICS AND BUSINESS. THE ECONOMICAL APPLICATION OF MATHEMATICS

The European Higher Education Area promotes the competences-based learning. The knowledge of concepts and their applying knowledge in practice are combined there. Numerous generic competences figure in Degrees Qualifications. However, there are some relevant competences analyzed in the second phase of the project Tuning such as:

1. Capacity of analysis and synthesis.
2. Capacity for applying knowledge in practice.
3. Basic general Knowledge in the field of study.
4. Information management skills.
5. Interpersonal skills.
6. Ability to work autonomously.
7. Elemental computing skills.
8. Ability of investigation.

These can be developed in greater or smaller measure depending on the subjects profile and the teaching methodology used. In the case of Mathematics for Economics and Business, its development can be tackled by practical exercises based on the study and analysis of concepts and economical phenomenons. These applications analyze and study economical problems which use mathematical techniques for their solving as it follows:

- Planning the solving of economical problems.
- Setting economic and business problems out in mathematical terms.
- Selecting right mathematical instruments for the solving and using them.
- Interpreting the mathematical results of each problem in economical terms adequately.
- Understanding economical and business concepts through basic mathematical notions and models.
- Distinguishing and identifying mathematical concepts in economical problems.
- Using the deductive method.

The essay done by the student when dealing with a practical exercise of economical content help them developing skills related to the three generic competences exposed above: the capacity of analysis and synthesis, the capacity of applying knowledge in practice, the basic general knowledge in the field of study, and, of course, the capacity to solve problems. They can also develop skills associated with the use of certain computer packs and specific software which can be used in the resolution of several kinds of problems. However, some other interesting aspects of elemental computing skills aren't tackled, such as the use of word processor and spreadsheets or the use of technology as an instrument to obtain information and new ways of communication.

Interpersonal skills, autonomy, abilities to investigate and the use of information are not directly related

to the objectives and contents of this subject, that's why its development depends on the teaching methodology used and the learning activities of investigation proposed by students. It's unusual to suggest favoring the development of these skills in subjects of Mathematics for Economics and Business, since they are not directly related to the matter.

Therefore, teaching the economical applications of Mathematics allow the development of some generic competences but doesn't deal with the acquisition of others which are also essential to the student's education towards their professional future.

4 THE METHODOLOGY OF WEBQUEST, MINIQUEST AND TREASURE HUNT AND THE OBJECTIVES OF THE EUROPEAN HIGHER EDUCATION AREA.

There are teaching strategies which include in their educational objectives the eight generic competences already exposed. WebQuest, MiniQuest and Treasure Hunt are among them. These activities have a common premise and profile but different level of difficulty. They are classified within the called *project-based learning* which is characterized by developing learning processes and constructing knowledge through the information obtained from Internet, starting with fixed contents previously determined by the teacher.

WebQuest was developed by Bernie Dodge in collaboration with Tom March in 1995 in San Diego University. Activities developed in WebQuest allow achieving the objectives of the European Higher Education Area related to the development of high level cognitive processes and the new roles of teacher and student [2]. These features are shared by MiniQuest and Treasure Hunt. This methodology is attractive to the student and let the teacher innovate developing a way of teaching-learning focused on competences development [5].

This methodology could be suitable to teach the practical part of the subject Mathematics for Economics and Business, the Mathematics Applications, by learning activities focused on the development of generic competences.

5 ECONOMICS APPLICATIONS OF MATHEMATICS AND THE METHODOLOGY OF WEBQUEST, MINIQUEST Y TREASURE HUNT.

The next step is verifying that this part of the subject can be developed under this methodological approach. Some applications of Differential and Integral Calculus are the use of derivatives in concepts of marginal function and elasticity of demand, the marginal rate of substitution can be computed via or the relationship between definite integral and the producer and consumer's surplus. These applications deal with real concepts and phenomenon so the students know the process used in economical studies and sometimes from different points of view.

It is necessary to check if the Economics Applications of Mathematics are suitable to be taught with the methodology of WebQuest using a project which promotes a significant learning process. In this case, they are adjusted to the features which must have a good and attractive WebQuest [10]:

- **real:** The economical concepts and phenomena studied are real.
- **enriching:** The knowledge can be dealt with from different points of view and sources, and must be related them to other contents.
- **relevant:** Addresses issues of importance to the training of the student for their future employments.

Now we can consider developing a tool to teaching Mathematics Applications for Economics and Business starting from the learning principles of WebQuest and Treasure Hunt.

6 ADAPTATION TO THE METHODOLOGY OF WEBQUEST AND TREASURE HUNT FOR TEACHING-LEARNING OF THE MATHEMATICS APPLICATION FOR ECONOMICS AND BUSINESS

The idea we start from is designing and creating an "**activity**" based in the methodology of WebQuest and Treasure Hunt respecting their learning principles:

- WebQuest: students deeply know about a topic doing research on it or solving a given problem.

- **Treasure Hunt:** students acquire knowledge starting from a series of questions whose answers develop using the available information in the selected resources of the Web.

The suggested activity allows the use of the information available on Internet to create a constructivist learning process starting from the idea of going through an investigation in which the student works in group and transforms the information available to obtain a final product. We have taken the basic features of WebQuest and Treasure Hunt that are most adequate for understanding of economical and mathematical concepts, so both the philosophy and aims of the methodology are kept in. An “**activity**” has the following sections:

- **Introduction:** It starts with a brief exposition about the economical concept or phenomenon studied in the activity, pointing the mathematical tool needed for its analysis.
- **Task:** the work the student must develop is indicated. Some general indications are provided for its making such as the formation of working groups, the time available to develop work, what must be made as a result of the developed Project and how to organize the time to develop the task.
- **Aims:** The objectives of knowledge related to the mathematical and economical contents of the activity and the competences associated to the study of any economical application of Mathematics.
- **Questions:** In this section are detailed a series of questions are arisen here in a way that in order to answer them it is necessary to describe, schematize, create lists, summarize, etc and develop some basic skills such as understanding and construction of knowledge. There are some straightforward questions are direct ones and are useful to identify economical and mathematical concepts. They are completed with little activities about the reason of a result (analysis), how to develop the study of an economical phenomenon (problem solving) or what to do (decisions making). Right after each question there are links to websites that contain the information to answer, and so make the searching process easier and avoiding students get lost among the information. Some resources are documents in a pdf and/or a PowerPoint format, they have been developed for those cases in which the websites didn't contain the information or it wasn't clear enough.
- **Big Question:** the student is asked to *identify the economical and mathematical concepts studied in the activity and the relationship between them*. In order to get this, the student must reflect and convert the information they have worked with during the activity to extract a conclusion or deduction. This question is advanced in *the task* so students can start selecting the information that is going to be used to make the answer.
- **Evaluation:** It is made by means of a valuation matrix or rubric with the characteristics to value. A numerical score is assigned to the answers as well.

The *activity* is adjusted to the concept and structure of Treasure Hunt, but it has important differences with this one. *The questions* of Treasure Hunt don't usually include problems to solve or the exposition of final conclusions [1] like in the *activity* we proposed. We can find in WebQuest this kind of question and also the evaluation made using a rubric.

The project is considered to be developed in a group, although it is possible to work it individually. They are designed to be developed in sessions during two hours and a half.

We had created activities for several economic applications dealing with different contents but related among them, so the economical concepts studied in a particular activity are generalized or extend others related to them in later activities.

7 CONCLUSIONS

The economical applications of Mathematics are an important part of the discipline Mathematics for Economics and Business. They are usually included within the practical part to show students the usefulness of Mathematics in the Economics and Business world. In addition, it allows the students to develop some generic competences relevant for their future employment such as the capacity of analysis and synthesis, the capacity of applying knowledge in practice, the basic general knowledge in the field of study, and, of course, the capacity to solve problems.

This project starts from the necessity of looking for new methodologies to teaching-learning the economical applications of Mathematics which would allow to include the development of relevant generic competences included in the Tuning Project, within the learning objectives of the subject, converting the teacher to guide of the process and making the student play the leading role.

The features of this part of the subject let them adequate themselves to the project-based learning methodologies through the Internet, specially WebQuest and Treasure Hunt. Starting from the principles and structures of both of them, some *activities* have been designed in which development the student himself plays the leading role of the teaching-learning process, the teacher's role shifts to the background as a guide in the process. These can be developed in different contexts in the Degrees of Economics and Business to promote the development of generic competences.

In this kind of subjects it is not usual to find methodological innovations. These projects allowed us begin to use a new methodological perspective to the learning of contents and development of competences in a quantitative-kind subject within the studies of Economics and Business. With this paper we are trying to introduce new teaching tools that allow us fulfilling the objectives of European Higher Education Area.

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