

# Chapter 41

## Moodle-Based Tool to Improve Teaching and Learning of Relational Databases Design and SQL DML Queries

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### ABSTRACT

*The challenge to prepare the graduates for working in a constantly changing environment like software engineering requires an effective learning framework. This chapter presents a tool, integrated in the Moodle learning management system, that allows students to train the process of designing relational databases. The tool also allows them to practice with SQL queries that are executed over relational databases previously designed. This chapter also describes the result of a qualitative analysis of its use in an engineering course offered at the University of Valladolid and focused on the teaching of the Web applications development. The results of the refereed study reveal that the tool was found useful by both students and teachers to support the teaching and learning process of relational databases.*

### INTRODUCTION

Computer programming university courses are concerned with providing the students with not only theoretical knowledge but also with the required skills for achieving a more efficient programming, which is something required for work-

ing in software development (Sancho-Thomas et al., 2009). However, contrariwise programming learning requires, today students are playing an increasingly passive role in their own education; the rise of the dropout rate and the lowering in the grades show signs of it. In this sense, e-learning tries to promote a more active involvement of the

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students in their own learning process. As Law et al. (2010) suggest, an e-learning environment makes easy and can improve the motivation for learning and self-efficacy. Furthermore, in order to strengthen learners' programming skills, they need to do a lot of practice. Hence, practical activities play an important role in the learning process (Thomas & Paine, 2000). Another reason of trying to combine mainstream education system (face-to-face classes) with new e-learning systems is that sometimes professors has to work with crowded lab classes, where paying due attention to each student is practically impossible. By doing so, the professor can better utilize his/her time as well as take advantage of the learning time outside of school hours, so the effective learning time increases and quality of teaching clearly improves, which can be key in computer programming learning.

Therefore, the objectives of this chapter are to present a Moodle-based tool that aims to support the teaching and learning process of a relational database design, as well as the teaching and learning process of SQL DML queries to be executed over a previously designed relational database. As well as to test the tool in a university academic environment in order to determine the usefulness of the tool in such a context for both students and teachers.

## **BACKGROUND**

The relational database was born in 1970 when E.F. Codd, a researcher at IBM, wrote a paper outlining the process of defining such a database. Since then, relational databases have grown in popularity to become the standard (Sumathi & Esakkirajan, 2007) (Churcher, 2012).

Originally, databases were flat. This means that the information was stored in one long text file, called a tab delimited file. Each entry in the tab delimited file was separated by a special character, such as a vertical bar (|). Each entry contained

multiple pieces of information (fields) about a particular object or person grouped together as a record. The text file made it difficult to search for specific information or to create reports that included only certain fields from each record. An example of the file created by a flat database could be the following:

```
Lname, FName, Age, Salary|Page,  
Jane, 30, $3200|Doherty, Mark, 43,  
$4320|Murray, Peter, 34, $2715|Ro-  
land, Richard, 40, $2730
```

With such a file, it would be necessary to search sequentially through the entire file to gather related information, such as Lname or salary. On the contrary, a relational database allows to easily find specific information as well as to sort information based on any field and to generate reports that contain only certain fields from each record. Relational databases use tables to store information. The standard fields and records are represented as columns (fields) and rows (records) in a table.

By using a relational database, information can be quickly compared because of the arrangement of data in columns. The relational database model takes advantage of this uniformity to build new tables out of required information from existing tables. This way, it takes advantage of the relationship of similar data to increase the speed and versatility of the database.

Relational databases are created and manipulated by using a special computer language, named the Structured Query Language (SQL), which is the standard for database interoperability. SQL is the foundation for all of the popular Database Management Systems (DBMS) available today, from Access to Oracle.

The keystone of the Relational Model are the relations, which are made up of attributes. A relation is a set of attributes with values for each attribute such that each attribute name must be unique, each attribute value must be a single value

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