E-LEARNING TOOLS IN TEACHING DATABASE CONCEPTS

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Abstract
The paper focuses on teaching database concepts using interactive methods and e-learning tools. We describe the tools that we use, together with their learning impact, and discuss students feedback towards the course, which is delivered for BA management specialization students.

The educational material has been prepared and provided within UBBonline e-learning platform. Main course topics are structured on: database concepts, Access databases and tables, Access queries, Access forms and pages, Access reports and Access macros e-learning systems. We have chosen Access to exemplify database facilities because it is interactive, user friendly, suitable for management students, and its interface is similar to other well known Office tools. Acquiring the proposed Access skills brings students not only specific capabilities of designing their own databases with medium complexity (for example, form managing clients), but also of understanding the basis of structuring data for the ERP systems that will later be implemented and used in organizations. Students will therefore perform better in providing user input and requirements in the process of information system implementation.

The educational e-learning tools have been prepared on the UBBonline educational structure, containing: a modular e-learning resource with educational goals and resources for each topic, discussions, tasks, communication facilities: e-mail and chat. Seminar exercises are solved in face to face meetings and pursue the course structure. We have designed specific exercises and requirements for practicing Access objects on students, library and personnel databases. Tasks are posted and assigned on the portal but also interactively discussed and solved in face to face classes, based on the learning material, group work and practical applications.

We also analyze the results obtained by students in latest year exams, discussing the results in theoretical quiz and practical grades, as well as in examination chronology.

We have prepared an on-line quiz for evaluating the course, by using the portal's built in facilities. Students express a positive feedback towards the course content, the acquired knowledge and interactive teaching methods.

The paper reveals the importance of teaching database concepts for management specializations and proposes a set of educational methods which have a good student feed-back.

Keywords: teaching database concepts, interactive educational resources, educational feed-back, UBBonline e-learning portal.

1 INTRODUCTION
Within the framework of knowledge based society, information technologies strongly influence learning processes [13], enabling the development of the student centered learning model [1] from the educational point of view and of efficient e-learning systems from the technical point of view. E-learning systems [11] assist the learning partners, teachers and students, in creating and sharing a cooperative, explorative and multidisciplinary learning environment, supporting learning efficiency.

E-learning systems may provide fairly standardized [17], [19] or more flexible facilities [16], [18]. UBBonline portal that we have implementing and we use within the present paper adopts a flexible solution [16] which also enables the integration of our dedicated information systems [4], [5].

In previous papers, we describe the architecture and principles of UBBonline portal [2], [3], [4], the e-learning facilities that are provided [5], [6] and evaluate them [7]. In [8], we address strategies for teaching IT management, using interactive methods and e-learning tools. In [9] we compare BA and MA student feed-back on the provided e-Learning facilities.

The present paper focuses on teaching database concepts using interactive methods and e-learning tools, using UBBonline portal. The educational resources that we have prepared and used are
overviewed in section 2. We present in section 3 the practical tasks that we have prepare in order to
develop the desired practical skills in database design and processing using Access database
management system. In section 4 we address student feed-back to the course content and facilities
that have been provided, the survey being created with built-in portal facilities. Section 5 is dedicated
to analyzing the results of the students at the theoretical evaluation test. We conclude that students
express a positive perception on the usefulness of the course content and attained skills in processing
databases using Access database management system.

2 LEARNING RESOURCES AND FACILITIES

The course unfolds along one semester, with 7 courses and 7 seminars. Main course topics are
structured on: 1 - database concepts; 2 - Access basic facilities, tables, relations and indexes; 3 -
selection, synthesis and action Access queries; 4 - Access forms, 5 - Access reports and 6 - Access
macros. The last topic covers 7 - the course synthesis and overview.

The types of educational resources that have been developed are described in [8], [9]. The most
important resource is the educational content, with a modular structure on: learning goals, learning
resources, feed-back resources, references and evaluation information – see fig. 1. This facility has
important learning advantages since students can easily pursue the educational aims and cover the
learning and feed-back resources [8], [9]. For each educational module, adequate knowledge
assimilation or skill building may be verified according to criteria posted in the evaluation section of
each educational module [8]. Students generally have a good perception regarding the modular
learning content tool [7].

There are also available document and media libraries, discussions, surveys, tasks – see [8] for
details.

UBBonline portal is automatically provisioned with information (specializations, curricula, student and
educational information) from AcademicInfo system, on a daily bases [6] (synchronization procedures
run daily).

Communication facilities comprise the built-in portal ones: user communities, shared discussions
(see fig. 5), e-mail communication (OWA Exchange server is used for teachers and employees, and
MS Office 365 facility for students), instant messaging (implemented with MS Office Lync Server),
RSS, alerts and warning messages, blogs and wikis – see [6], [7] for details. We note that the e-mail
tool provides a proficient calendar facility. Besides the videoconferencing facility provided by Lync
Server, a dedicated videoconferencing system installed in the lecture halls (Picture tell type) is also
available.

![Fig. 1: Modular educational content](image)

Built-in portal evaluation tools include also interactive facilities, like tasks and surveys - see [5] for
details.
Tasks are interactive facilities associated to disciplines, in this case, the Database course. When a task is created by a teacher, it can be assigned to specific users or user groups; consequent to receiving the task, students “reply” by uploading specific documents in order to comply task requests. Tasks are automatically distributed to the students who are enrolled in the course (according to study contracts information automatically provisioned from AcademicInfo system). Tasks are further detailed in [8].

Besides being posted and assigned on the portal, tasks including practical assignments – see section 3 – have also been interactively discussed and solved in face to face classes, based on the learning material, exercises, team work and learning by discovery techniques. Task interactivity has a very good educational impact on students' knowledge acquisition rate and on educational efficiency.

My site is a personal site created for each portal user, providing a dedicated workspace for the user’s documents, tasks, surveys, blog, site [6]. The content of ‘My site’ appears as a collection of customizable web parts. Actually, the whole portal is a collection of web parts, in the educational facilities section design permissions belong to teachers. My site facilities are detailed in [8].

3 PRACTICAL TASKS

As practical assignments during the educational module, we have prepared exercises involving three types of databases, providing the structures below:

1 Student
   Stud[StudId, Name, FirstName, Address, City, DateOfBirth]
   Courses[CourseId, CourseTitle, Teacher, ECTS]
   Grades[StudId, CourseId, Grade]
   Groups[StudId, Group, Year, Specialization]

2 Library
   Books[BookId, Title, Author, PublishingHouse, Year, Borrowed]
   Readers[ReaderId, Name, FirstName, Address]
   BorrowedBooks[ReaderId, BookId, BorrowingDate, DueTo]
   Inventory[Title, Author, NoOfCopies]

3 Employees (simple structure)
   Personnel [PersonId, Name, FirstName, Address, City, DateOfBirth]
   Functions [PersonId, Profession, Salary, Function, YearsofEmployment].

The practical assignments have been structured on the following topics:

1 Creating the tables, the proposed relationships and the indexes

2 Practicing selection and synthesis queries. Examples for the Student database:

   Selection queries: practicing Find Unmatched Query Wizard and Find Duplicates Query Wizard and underlining cases of usage; designing a query containing [StudId, Name, FirstName, CourseId, CourseTitle, Grade] ordered on various criteria, and further imposing conditions: referring to grade interval, students' age, names and groups

   Synthesis queries: average grade for each group, number of students in each group and specialization (solutions with Totals and adequate Group by and Crosstab), the total number of ECTS for each student, for each course and group, computing the number of students who attended exams (both with Totals and adequate Group by and Crosstab). We note that we emphasis on explaining the significance of the grouping field – Group by (associations with Pivot Table in Excel and with the similar significance that will appear in Reports) and the computation (calculus field) – Value.

3 Practicing action queries – on the Employees database. Students are instructed how to recognize the type of action query they have to use: Make Table Query, Append Query, Update Query, Delete Query. We further give examples:
Update Query: Adding a value to the salary of the employees (constant and read from the keyboard), indexing the salary of the employees with a certain percentage (constant and read from the keyboard), updating the profession of the employees with the id included in a given interval.

Make Table Query: Copying Personnel into a new table, creating new tables containing the employees who verify a certain condition on age, respectively on salary

Append Query: Adding the employees with a certain condition on age to the previously created table

Delete Query: Deleting employees with certain conditions on age and PersonId-s

4 Practicing forms. Given the complexity of forms and reports design, we start by using a wizard and further on we make all necessary changes in Design View. We emphasize on explaining the characteristics of the basic form and report layouts: tabular and columnar. Then we work on the following examples and exercises:

- Practicing the available form wizards and recognizing tabular and columnar designs; observing the types of objects in Design view
- For the Student database: we create a tabular form on the Grades table and a columnar form on Stud table, further on, we add into the Stud form the Grade form as a subform. We emphasize on explaining the Data Properties of the subform and the link between master and child tables on the relation field, in this case, StudId
- For the Library database: a columnar form containing the Books – Titles, including a subform comprising the characteristics of each title: BookId, Author, PublishingHouse, Year, Borrowed. Observation: The latter for is previously generated as a tabular on Books table

5 Practicing reports. As explained above, due to object complexity, we create reports based on reports interactively (or automatically) created using Wizards and then performing the necessary changes in Design View. We emphasize on the significance of grouping levels, explaining the Group by and Value types of fields, and associating their significance with the knowledge already acquired within Queries. Reports may have many grouping levels, which should be specified from the largest to the smallest. Examples and exercises:

- a report containing students' grades for each course and the average grade for each specialization, group and student. Recommendation: Grouping levels will be specified for: Specialization, Group, StudId. Computing the number of students for each specialization – the grouping filed will be set to Specialization and in Design view the Combo box computation object on StudId will be updated using the function =Count()
- For the Library database: a report containing full information on borrowed and existing books, grouped by title (Recommendation: Grouping fields will be set to Borrowed, Title) and computing the total number of borrowed and existing books (computation performed similarly to the above one, adding Count function in Design View)

6 Practicing macros. We practice simple operations, as: opening specified tables and queries; opening specified forms (opening the database in update operations), finding the student / person with a given name: we open the corresponding table and we use the FindRecord action (the OnlyCurrentField parameter must be set to No)

7 Revision and synthesis assignments. The revision topic overviews the acquired skills on Student and Library databases. For the students who have already completed these assignments, we propose, as optional assignments, two supplemental databases: Warehouse and Bank accounts.

Revision assignments are similar to and prepare students for the practical exam, within which students have to be able to structure databases similar to the ones that have been discussed (Students and Library), to create them and to perform processing operations similar to the ones that have been practiced during the practical tasks, using selection, synthesis and action queries, as well as forms and subforms, reports with grouping levels and simple macros.

4 STUDENT FEED-BACK

In order to evaluate the student feed-back on the Database course that we analyze, we have developed a dedicated questionnaire – see fig. 2. The questionnaire was created and interpreted
using the survey functionality built-in in the platform (MS Share Point Portal); we underline in this respect the flexibility of the platform’s tools. We present here the results obtained in the academic year 2016-2017, when, from a group of 27 students, with 20 students attending classes fairly regularly, we had 15 responses.

Regarding the subject group profile, since the students were enrolled in the second BA year, all subjects were included in the [18-22] age group. 80% members of the subject group were female students and 20% - male students –fig. 3. All students in the subject group belong to the economic and real sciences field.

We note that although most questions referred to the course content placed on the platform, some of the questions referred to the platform functionalities and were addressed by students accordingly.

The subject students positively evaluated platform functionalities – fig. 4 as: good and very good – 73%, moderate – 20%, the average weight of this criteria being 3.8 on a scale 1 (low) -5 (high).

Functionalities regarding the educational content of the course had also a very good feedback among students: they were rated as very good by 27% of the subjects, good by 53% of the subjects and moderate by 20% of the subjects – fig. 5 . The average weight of this criteria is 4.06, on a scale 1 (low) - 5 (high).

The efficiency of the educational resources is the most enthusiastically rated: 67% very good!!, 20% good and 13% moderate– see fig. 6. The average weighted grade of this criteria is 4.53 on a scale 1 (low) - 5 (high).

The efficiency of accessing the educational resources is fairly well rated: 20% moderate, 40% good, 13% very good – see fig. 7. The average weighted grade of this criteria is 3.4 on a scale 1 (low) - 5 (high). We note that some of the students were not very familiar with the content structure, even if any resource is available by at most 2 clicks.
Communication functionalities (mail, chat, discussion lists, blogs) – see fig. 8 – are also fairly well rated: 20% very good, 33% good, only 17% moderate and only 13% weak. The average weighted grade of this criteria is 3.6 on a scale 1 (low) - 5 (high). We note in this respect that some problems were caused by the very high number of Office 365 accounts registered within our institution.

We can conclude that the learning facilities provided for the analyzed course within the portal have a very good feedback, most evaluated facilities displaying a weighted grade around 4, some of them even greater and some - around 3.5 , on a scale 1-5 .

We may conclude that students express a positive feedback towards the importance of the course content, interactive teaching methods and its relevance to their educational path.

Nevertheless, these facilities should be used for all courses, by filling in specific content in order to address the students' educational needs. Proficient software tools prove their efficiency only when appropriately used on specific data; this principle is even more relevant when applied in the field of e-learning. We can state that efficient portal functionalities must be sustained by an adequate usage level and content filling -in in order to prove their proficiency [9]

5 STUDENT RESULTS

In order to evaluate student knowledge assimilation of the database concepts, we have designed a dedicated quiz, containing 50 questions. The quiz has been implemented as an Access application that we have designed for IT theoretical tests – see fig. 9.

The grading algorithm that we have implemented adds an amount proportional with the number of correct alternatives per test for each correct answer and subtracts an amount proportional with the number of incorrect alternatives for each incorrect answer and finally scales the grades in the interval [3, 10]. Questions are randomly generated, in a number specified as a parameter in the test configuration, from a database of questions, previously entered, together with their correct responses.

The exam has been attended by the 27 students enrolled in the specialization. We computed the final grade as the average between the theoretical grade and the practical grade, obtained during the practical examination.
The grade distribution for the theoretical test is given in fig. 10, we can notice that it pursues a genuine Gauss distribution: 22% of the students have obtained grades in the interval [5,7), the majority of students – 37% have obtained grades in the interval [7,8.5), 22% have obtained grades in the interval [8.5,9.5), and 6.22% have obtained grades in the interval [9.5,10].
[8.5, 9.5) and 15% – highest grades, >=9.5. We note that highest grades, in the interval [8.5, 10] comprise an encouraging percentage of 37%, equal to the highest value in the Gauss distribution, and corresponding to the medium grade interval [7,8.5). We therefore positively appreciate the grade distribution that was obtained by the students during the evaluation.

The practical grade distribution for the theoretical test is given in fig. 11: 27% of the students have obtained grades in the interval [5,7), the majority of students –23% have obtained grades in the interval [7,8.5), 19% have obtained grades in the interval [8.5, 9.5) and 19% – highest grades, >=9.5. We note that highest grades, in the interval [8.5, 10] comprise a considerable percentage of 38%, greater than the one corresponding to the medium grade interval [7,8.5). Consequently, we can also positively appreciate the grade distribution that was obtained by the students during the practical evaluation.

Comparing the students’ responses in the course evaluation quiz and their results, we can notice a certain consistency, the majority of the students obtaining good or satisfactory results and also understanding the relevance of the course topic.

6 CONCLUSION

The paper focuses on teaching database concepts using interactive methods and e-learning tools, using UBBonline portal, a course delivered for BA students. The course evaluation quiz and the student grades analysis are performed for the academic year 2016-2017.

We reveal the advantages that the provided resources and tools have in the learning process, based on the case study of the analyzed disciplines. We also present a brief analysis of the grading process, using a computer-assisted quiz.

We describe the survey that we have developed, using built-in portal facilities, for evaluating the efficiency of the electronic resources and learning tools provided within the discipline’s site, and we discuss its results. Students express a positive perception and acknowledge the advantages of having the educational resources available at any time and of using guidance and communication tools.

Consequent to processing and interpreting the course evaluation quiz, we can state that students express a positive perception on the learning resources and tools that we have prepared for them.

The analysis of the grades for the studied course reveals a Gauss distribution, the majority of the students obtaining good and satisfactory results. We note that the theoretical test was implemented using a dedicated application created for this purpose.

Comparing the course evaluation and the student results, we may notice a certain consistency, the majority of the students obtaining good or satisfactory results and also understanding the relevance of the course topic.

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