TEACHING METHODOLOGY OF INFORMATION SYSTEMS

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Keywords: Information System, Teaching, Structured Methodology, MS Access.

Abstract: The article describes the content and methodology of teaching the foundations of information systems development. It presents the content and structure of the course, motivational aspects applied, and an illustrative example of a credit assignment – the result of student's work. As a theoretical approach, the structured methodology for information systems development is applied. The physical model is created in the Microsoft Access database management system.

1 INTRODUCTION

The development of information systems (IS) for commercial use is being executed through agile methodologies and object approaches.

Predominantly, web applications are being created, and working with IS by using mobile devices is being solved.

Yet we should not condemn some historical methodology approaches, such as structured methodology; we should use them appropriately with respect to the new conditions, bearing in mind what is important and how they can be useful in teaching.

Although the structured methodology is rather historical, its application is still required, e.g. (Giannoccaro, 2007).

The article presents the experience gained in teaching the course named 'Development and administration of IS', which is based on a structured approach. It is specified in studies for bachelor's degree as follows:

1. The introductory course in the 'Information Systems' programme for future specialists in information technology (IT).
2. The course providing basic information about IS for future specialists in business (economics, management, etc.).

The article describes the structure and content of the course, pays attention to its motivating factors, shows an example of student's work and evaluates the benefits of the course.

2 STRUCTURE AND CONTENT OF THE COURSE

The course begins with the analysis of IS issues. It includes the following topics: the concept of IS, its meaning and classification, data - information – knowledge, database system (DBS), data structures of database systems, the function of database management system (DBMS) and database (DB) properties.

Then follows the teaching of the IS modelling. It includes the topics of the IS model, general principles of modelling, IS life cycle, methodology - method - technique - tool.

After that a structured approach to IS development and a conceptual level of modelling are introduced. This part can be described as the core for understanding the field and the proper basis for analytical thinking of an IS creator. The structured methodology (levels and dimensions of modelling, application of general approaches to modelling, a conceptual level model) are explained. The constructs and rules of the entity-relationship diagram (ERD), functional diagram (FD) and data dictionary (DD) are presented.

The course also includes the creation of IS by students themselves. The necessary information is conveyed through an example, starting with the specifications and finding requirements for the IS, proceeding to various levels of modelling, creating the custom application and documenting the process and outcome. The theme for the creation of an IS is chosen by the students themselves. The procedure

for the IS development and the outcome are given by detailed guidelines.

In the last part of the course, the logical and physical levels of IS modelling are introduced. They include the relational data model (RDM), the transformation of the ERD to RDM, RDM normalization, and relational operations. The development environment of the database management system (DBMS), MS Access and the description of the basic elements of the application (table, query, form and report) are presented.

The above mentioned structure of the course is suitable for teaching the IT specialists. In the case of the 'business' oriented students, some of the passages can be omitted or modified, and thus the learning objectives can be adapted to the students' needs. It is not necessary to present the details of DBS, it is possible to replace the definition of the RDM by the 'table view of data', to omit normalization and relational operations. In addition, this group of students could become more familiar with the work in MS Access.

The course requirements include a course credit and an examination. The credit is earned for developing and documenting an IS. Students use a textbook (Burita, 2005).

3 MOTIVATIONAL ASPECTS OF THE COURSE

The basic motivational tool is continuous repetition of the teaching content and checking the students' skills and knowledge by testing them. Their test results are part of their final evaluation. In addition, the process of the IS creation is checked individually, the ERD design and its transformation into the RDM are discusses.

A well-proven motivational tool is the choice of the IS theme according to student's interest. It is easier to design and create an IS when the student is familiar with its environment and has a positive relationship with it. After several years of assigning this task, it can be summarized that the most popular topics for IS creations are:

- ICT (computers, graphic cards, mobile phones, software, data media, satellite communication, errors of security codes, overview on signals).
- Trade and services (car sales, motorcycle sales, car repair service, mobile phones, music, food).

- Music (music bands and singers, recorded music, DVD, musical instruments).
- Sports competition (soccer, fire sports, athletics, shooting, body building).
- Teaching (student records, future practice for students, eLearning exercises).
- Machinery (automobiles, motorcycles, weapons).

But the students also choose less frequent topics such as:

- Geography (cities, geocaching).
- Games (spacecraft).
- Lifestyle (nutrition, beer).
- Records of attendance at work.
- Books and libraries.

The structure of instruction and the way the tasks are assigned and evaluated lead the students to independence. This is especially evident when they work on their course credit task. Brief orientation and basic demands for their credit task are given to students in the form of written instructions. After the approval of the theme for their IS development and specification of the IS requirements, they proceed, if possible, on their own. The important progressive phases of work (conceptual and logical model) are discussed with the teacher, and the students continue only after submitting the outcomes and obtaining the teacher's approval. The actual development tool for the implementation of IS is not presented in detail at lectures. It is up to the students to master work with MS Access; they themselves have to acquire the necessary aids. Or they may even choose other software development framework (Delphi, PHP, etc.). The submission of the course credit assignment is interactive; the students respond to the teacher's comments via electronic means of communication.

4 EXAMPLE

The example presents an outcome of student's work in the academic year 2011-12. Its theme is 'Geocaching' (Bielik, 2011). Based on the documentation of this assignment, the following parts will be presented:

- Assignment for the IS development.
- Entity-relationship diagram (ERD), Figure 1.
- Data dictionary (DD), Figure 2.
- Functional diagram (FD), Figure 3.
- Relational data model (RDM), Figure 4.
- Description of the final application.

Assignment Specification. Create an information system about cashes and their owners. The cache entity is characterized by the following attributes:

- the name of the cache
- hint
- the date of creation
- the date of the last visit
- coordinates

The cache entity is further specified by the entities of type and size of the cache and the difficulty of the terrain where the cache is located.

The person entity (the owner of the cache) is characterized by the following attributes:

- owners' name
- the date of creation the account
- the number of caches found

The IS should allow for saving, deleting, editing and searching the data from the stored data and the creation of required reports.
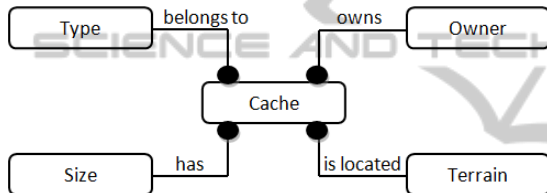

Figure 1: Entity-relationship diagram [Source: author].

Entity	Attribute	Date Type	Length	Obligation	Primary Key
Cache	C_ID	Number		Y	PK
	C_Title	Text	20	Y	
	C_Hint	Text	50	N	
	C_DateCreate	Date		Y	
	C_DateVisit	Date		N	
	C_Coordinates	Text	15	Y	
Type	T_ID	Number		Y	PK
	T_Title	Text	10	Y	
Size	S_ID	Number		Y	PK
	S_Size	Text	10	Y	
Terrain	Ter_ID	Number		Y	PK
	Ter_Terrain	Number		Y	
Owner	O_ID	Number		Y	PK
	O_Name	Text	20	Y	
	O_DateCreate	Date		Y	
	O_NumFound	Number	7	N	

Figure 2: Data dictionary [Source: author].

The IS about caches and their owners was created in MS Access DBMS. The IS provides users with convenient and clear browsing through data about cashes and their owners. To manage the database, functions for adding, deleting, and editing data are available. The program also allows the creation of reports according to selected criteria.
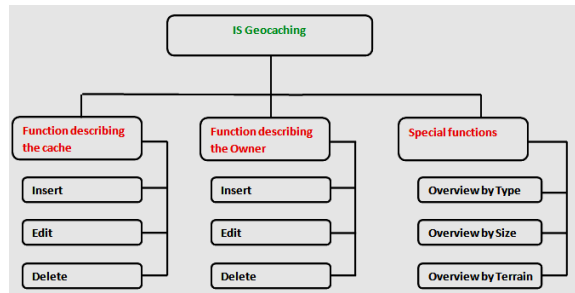

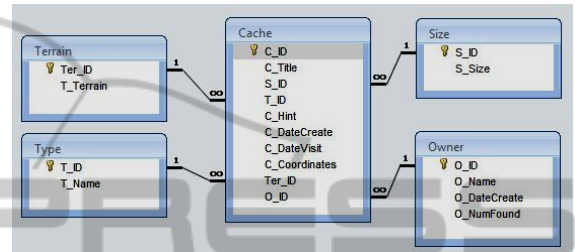Figure 3: Functional diagram [Source: author].

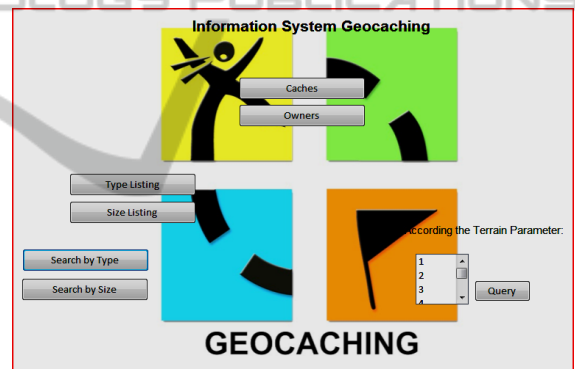Figure 4: Database structure on the RDM [Source: author].

Figure 5: User interface of the application [Source: author].

The main menu (see Figure 5) offers seven function buttons. Clicking the **'Caches'** button enable the users to view the data about cashes; they can be added, edited or deleted. Clicking the **'Owners'** button provides the users with similar functions concerning their owners (see Figure 6).

By clicking the **'Type Listing'**, the users get a report in which caches are sorted by types (see Figure 7). The **'Size Listing'** button offers the same function; the set contains all caches sorted by size. By clicking the **'Search by Type'** button, the users get a form in which they can choose the type of cache that they want to be displayed.

The **'Search by Size'** button has a similar function as the type of cache, but it is arranged by size. The last function of the menu is a list, where the user can select the level of terrain difficulty.

Clicking the **'Query'** button shows the table of caches selected according to the degree of terrain difficulty.
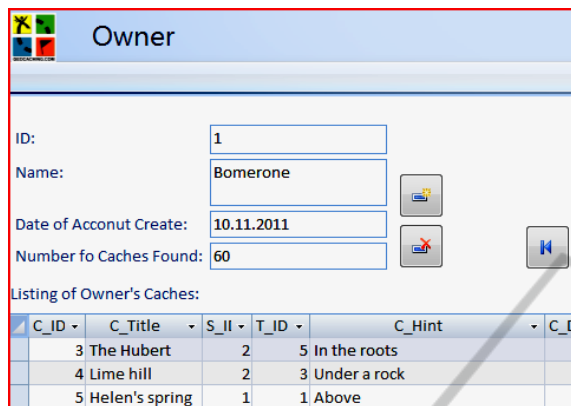

Figure 6: Information about the owners [Source: author].

Figure 7: Report on the types of cashes.

5 IMPORTANCE AND BENEFITS

The importance of the course for 'business' oriented students lies in obtaining comprehensive theoretical information and practical experience in information systems and their development. Certainly, the subject contributes to the students' ability to document the results of their work and to work independently on an assignment.

The future IT specialists should benefit from the course by acquiring strong knowledge of basic concepts of information systems, which can be further developed in their further study and practice. The students do not need further expansion of the knowledge concerning the relational data model in the future, which, despite all the advances in IT, is nearly 100% presented in current DBMS.

An important benefit of the course is the development of students' ability to work independently and to document the results of their work.

In both groups of students, the evaluation of the documentation of their IS is aimed at encouraging students to work professionally with a text editor. It is truly surprising that most of our secondary schools graduates are not ready to create quality documents and are very poorly trained in the use of the office automation software.

6 CONCLUSIONS

The article summarizes the experience in teaching the foundations of IS. By stepwise refinement of the content and process of teaching, the course has reached the stage which guarantees its stability with the useful pieces of knowledge gained from methodological procedures applied, including the activation of students and their independent work development.

The article shows an illustrative example of student's work, which is presented without any corrections. The students' feedback on the course is positive; they appreciate the opportunity to become familiar with one of the approaches to IS development, and are grateful for the strong knowledge concerning the theory of IS modelling.

The preparation of undergraduate students includes the described course as an introduction to the study. So far, the students have received education in general subjects only and their expectations are set high. We can state that their ideas were met. They have obtained substantial foundations for further education in IS and gained deep interest in the study program.

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