

Development and Evaluation of CATAPEX Tutorial for the Database Practice Course

Katarina Karić^{1*}, Maja Radović¹, Katarina Mitrović¹

¹ University of Kragujevac, Faculty of Technical Sciences, Čačak, Serbia

*kacakaric123@gmail.com

Abstract: The paper presents the development of CATAPEX tutorial (*Camtasia Tutorial for Apex*) that is composed of five education video lessons. The tutorial describes application creation for a particular database "Radost". Its main goal is to help students to gain necessary skills in application development in APEX tool (Oracle Application Express). Also, a short questionnaire is conducted where students evaluate CATAPEX and results are presented as well.

Keywords: database; tutorial; Oracle Application Express

1. INTRODUCTION

Undergraduate students of the Faculty of Technical Sciences Čačak attend the Database practicum course in their third year of study. The curriculum of this course envisions the Oracle Application Express tool for application development of a demanding real database. During the course, it has been noticed that students show certain difficulties when creating some parts of the application, such as forms, reports based on SQL, menus, triggers, procedures, etc. Tutorials, as interactive software created learning tools, would help students to overcome these obstacles and acquire new skills using a step-by-step procedure [1].

Many researches are conducted on this topic since Oracle APEX is very important tool for teaching and learning and it is commonly used at many faculties. In research [2] authors propose a tutorial for system management and Oracle APEX. The development of the application is presented and the evaluation of the system is shown in this paper. Authors of paper [3] prepared a variety of challenging tasks that the students solved with the help of the Oracle APEX tool. This research showed that Oracle APEX can be used at all levels of higher education, even for the content that is not closely related to the field of computer science and informatics. The paper [4] is focused on an evaluation of APEX in respect of: administration, scalability and reliability for teaching; teaching and learning of introductory database application development; promotion and monitoring of engagement and feedback of learning; teaching and learning of more advanced database application development. The paper concludes with an overall positive view in relation to these four criteria and identifies areas of improvement for using APEX for teaching and learning. The

importance of Oracle APEX tool is also reflected in the number of books written to help users of all levels of knowledge.

However, literature research shows a lack of some significant tutorials in the Serbian language concerning this issue. Although students are considered to be fluent in English, that is not the case in practice. An additional problem is that many of these tutorials are developed by people whose English is not their native language which makes them difficult to understand regardless of the student's fluency.

Based on these findings, we have decided to create several trial tutorials in the Serbian language that will help students in overcoming before-mentioned issues. CATAPEX tutorial is composed of five tutorials that include main concepts that students have a problem with.

The rest of the paper covers the main features of APEX tool (Section 2), database project that is used as the tutorial foundation (Section 3), the structure of CATAPEX itself (Section 4), and its evaluation (Section 5). The last section of this paper is dedicated to the conclusion and future work (Section 6).

2. FEATURES OF ORACLE APPLICATION EXPRESS

Oracle Application Express [5] (APEX) is a low-code development tool offered by Oracle Cloud [6]. It enables users to quickly build professional data-driven web applications. The goal is to help programming-savvy users to relatively quickly develop and implement applications for different devices, from desktop to mobile.

Oracle Application Express has free and paid versions depending on the level of professionalism it provides. The free version covers all necessary features for students of the Faculty of Technical Sciences.

APEX consists of four main parts (Fig. 1):

- *App Builder*, used to create pages that make APEX application. It is also used for the development and maintenance of web dynamic applications.
- *SQL Workshop*, which provides a full database object explorer. Also, it provides an interface to run SQL queries and see query results.
- *Team Development*, which gives access to the rich collaborative development features of APEX.
- *App Gallery*, which includes a suite of predefined productivity applications that can be installed and used.

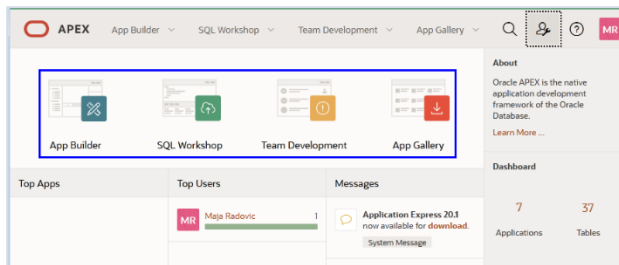


Figure 1. Four main parts of Oracle Application Express

The most significant advantages and capabilities of the APEX tool are: Creating reports, forms, charts and calendars for the database (within the application), launching and working within the Oracle database, flexibility in the appearance and functionality of the application, distribution of applications regardless of environment and platform, scalability and providing access for a large number of users without the need for a license.

Although an application can be created from scratch without an already created database, a fully formed database was used in this paper. In the following section, a brief description of database creation is explained.

3. DATABASE FOR PRESCHOOL INSTITUTION "RADOST"

Preschool institution "Radost" performs the activity of preschool education of children. "Radost" has headquarters in Čačak, Nadežde Petrović Street No. 8. It has 8 facilities i.e. kindergartens: "Nadežda Petrović", "Sunce", "Neven", "Majski cvet", "Bambi", "Radost 1", "Radost 2", "Boško Buha", in which children are accommodated in 63 groups of all-day stay. This institution needs to have up-to-date information on parents, children, institutions and groups, enrollment and placement of children in institutions, days of stay and absence

in the institution, and the method of calculating costs for used services (SCALE entity).

In order to answer institutional needs, the database "Radost" was developed following conceptual modeling rules that involve recognizing the needs of the system and using diagrams to represent them. In other words, the conceptual model integrates all entities, relationships, constraints, and processes into a single global view of the data in the enterprise [7].

The Entity-Relationship Diagram (ERD) is a high-level conceptual data model [8]. It is used to graphically represent the conceptual model. Entity-Relationship Diagram (ERD) was created based on the above-mentioned needs of the observed system (Fig. 2). The ERD model describes data as entities, relationships, and attributes.

An *Entity* represents the basic object of ERD. It can be said that an entity is a "thing" in the real world with an independent existence [8]. That means everything that can be unambiguously determined, identified, and distinguished. Each occurrence of an entity is unique and different. An *attribute* is a characteristic of an entity.

A *relationship* describes an association among entities. The notation used for ERD was Crow's foot modified by Oracle Corporation [9].

ERD model for the preschool institution "Radost" is presented in Fig. 2. Each entity is described with several attributes that reflect the real-world system:

- **PARENT** entity with attributes: *ID*, *Name*, *Surname*, *Unique identification number*, *Address*, *Place*, *Phone*, *Phone2*;
- **CHILD** entity with attributes: *ID*, *Name*, *Surname*, *Unique identification number*, *Date of birth*;
- **INSTITUTION** entity with key attributes: *ID*, *Name*, and *Address*;
- **GROUP** entity with attributes: *ID* and *Name Of Group*;
- **ENROLLMENT** entity with attributes: *Date of enrollment* and optional attribute *Date of drop out*, due to the occurrence that children during adulthood move from kindergarten to preschool or change the institution in which they are;
- **SCALE** entity with attributes: *ID*, *Payment options* such as: regular payment, Single parent child, second and third child, child from vulnerable groups and *Payment Percentage*;
- **RECORD** entity with attributes: *Date*, *Days of stay and absence* and optional attribute *Remark*;

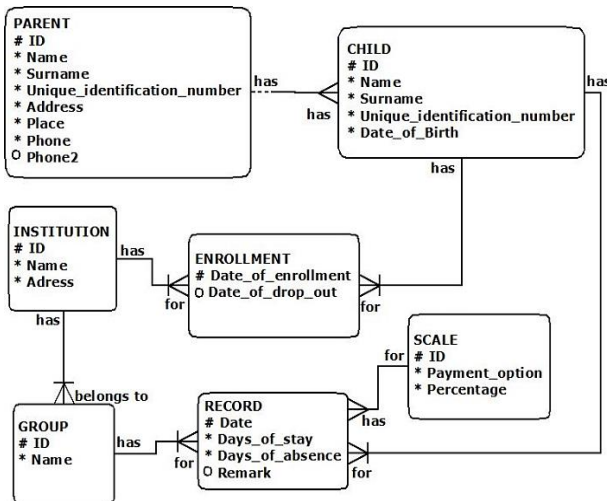


Figure 2. ERD for preschool institution "Radost"

The database scheme is created by transforming ERD. This implies that entities, attributes, and links are translated into relational database objects (Fig. 3). Entities are translated into tables, attributes into columns, and connections are represented by corresponding foreign keys.

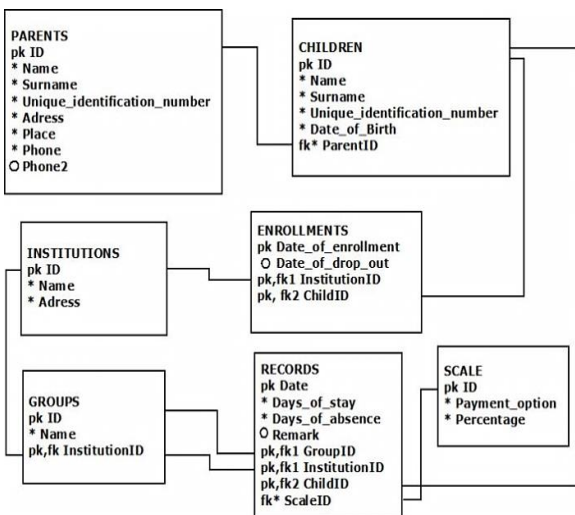


Figure 3. Relational diagram for preschool institution "Radost"

Based on the database, the application "Predškolska ustanova Radost" is created in APEX.

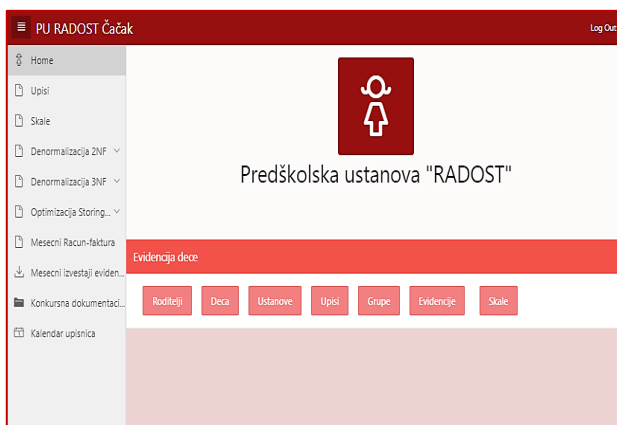


Figure 4. Home page of the "Radost" application

The application home page is presented in Fig. 4.

Applications made in APEX are highly user-oriented which implies that users who are not very familiar with computers can learn to use them with ease.

Easier ranking of children who applied for preschool, storing their records, easier management of groups and control over them, cost management as well as issuing reports is provided by APEX application for the institution "Radost".

The structure of CATAPEX tutorial is described in detail in the next section.

4. THE STRUCTURE OF THE CATAPEX TUTORIAL

CATAPEX tutorial is composed of five separate video tutorials. Tutorials are available online at: <https://tinyurl.com/y8ybscpr>. Camtasia software was used to create the CATAPEX tutorial [10]. It is a software suite, created and published by TechSmit for creating video tutorials and their presentations. The screen area to be recorded can be chosen freely, and audio or other multimedia recordings may be recorded at the same time or added separately from any other source and integrated into the Camtasia component of the product.

The necessary steps for the successful creation of the APEX database and application are explained in each tutorial. All explanations are presented through the example of creating a complete application for the preschool institution "Radost".

A short content description of each CATAPEX tutorial is given in Table 1.

Table 1. Content of each CATAPEX tutorial

Tutorial	Content
Introduction	The purpose of tutorials, to whom it is intended and explanation of its structure.
Table and foreign keys	How to create tables and keys through <i>SQL Commands</i> and <i>Object Browser</i> options.
Forms and Reports	How to use <i>App Builder</i> to create Pages i.e. <i>Forms and Reports</i> .
Navigation menu	How to create a Navigation menu to facilitate end-users navigation through the final application.
Home page	One of the ways how to edit Home page.

An insight into the topic that each tutorial covers is shown in the introduction.

Table and Foreign keys tutorial describes in detail the process of table creation in the example

of the PARENTS table. Two possible ways are shown, through SQL code or by object browser. Based on created tables the forms will be created as new pages that would be base for further work on the application.

Creating Forms and Reports tutorial describes in detail creation of new pages, i.e. forms and reports in the application. The forms are essential for data manipulation, such as: entry, update, delete, and search. Reports provide different ways of showing and shaping and resuming obtained information.

Creating Navigation Menu tutorial provides information about defining all necessary labels within the menu, so as to link labels to particular pages.

Creating a Home page tutorial gives information about Home page editing through adding buttons and linking them to forms. It also explains how to add application logo and visually adjust pages.

The screenshot of the Form and Report tutorial is presented in Fig. 5. It shows creation of form PARENTS with key attributes.

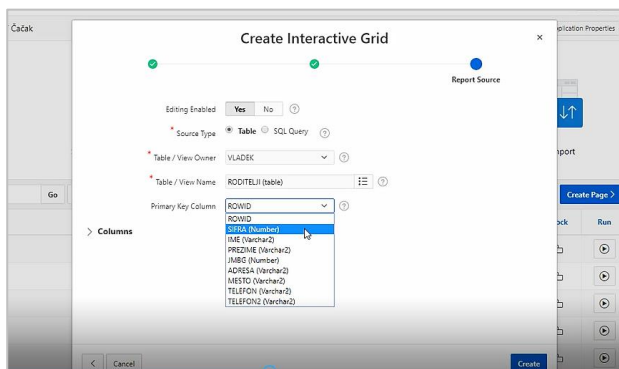


Figure 5. Screenshot of Form and Report tutorial

5. EVALUATION OF CATAPEX TUTORIAL

Since CATAPEX tutorial is in its trial version, the feedback from students about their satisfaction with tutorials and whether they are interested in upgrading it with an explanation of new options was needed.

Evaluation of CATAPEX tutorial was conducted at the end of the semester through a brief questionnaire (Table 2). Students were given five questions within this questionnaire.

The first question was related to the gender issue. Three questions are close-ended, and the last one was an open-ended question where students had the opportunity to express their views on the tutorial.

Table 2 also shows the results of the questionnaire.

Table 2: Questionnaire about student satisfaction with CATAPEX tutorials

Questions	Responses	Results
1. Gender	Male	21
	Female	9
2. Why did they access the tutorial?	It is an interesting topic.	6
	Because of the preparation for the project.	24
	No other alternative was offered.	1
	Other reason.	3
3. How many tutorials have you watched?	All	23
	All but one	1
	I missed a few	4
	I didn't look at any of them	2
4. Claims about different aspects of the tutorial:	The topic of the tutorial is interesting.	1(3) 2(5) 3(9) 4(13)
	The content of the tutorial is understandable.	1(0) 2(3) 3(7) 4(20)
	Tutorials encourage students to better design a project.	1(1) 2(3) 3(12) 4(14)
	Overall satisfied with the tutorial.	1(4) 2(4) 3(5) 4(17)
5. Students' suggestions	Open ended question	30

The questionnaire was answered by 30 students, 9 females, and 21 males. Based on obtained feedback it can be concluded that 70% of students access the tutorials because it helps them to finish their project in the *Database practice* course. Other responses can be seen in Fig. 6.

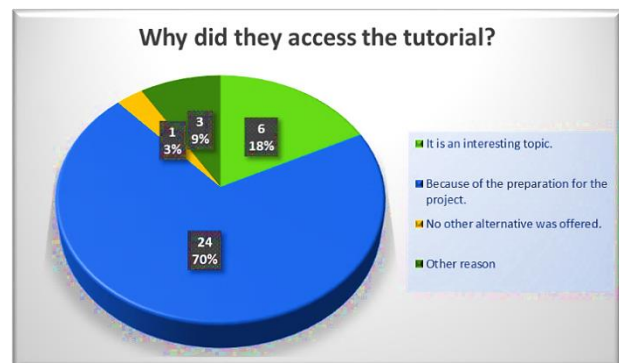


Figure 6. Pie diagram of responses to question about reasons to access tutorials

Responses to question about number of watched tutorials show that a relatively large percentage (77%) of students watched all the tutorials (Fig. 7). However, 7% didn't watch any of the tutorials.

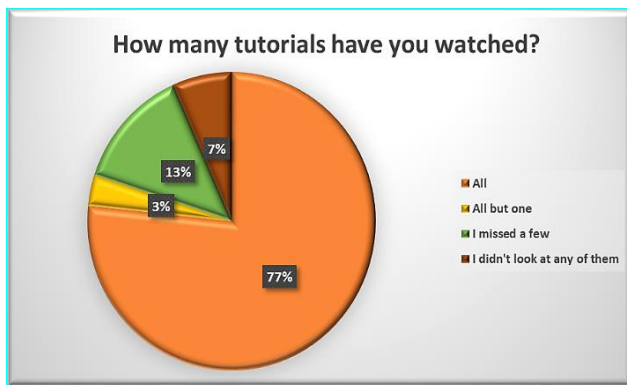


Figure 7. Pie diagram of responses to question about number of watched tutorials

The fourth question was about the degree of agreement about four statements. Fig. 8 shows that 13 students, i.e. 43 percentages agree with the first statement that the tutorials are interesting. What is more important, 66.7% agree with the second statement that the tutorials are understandable, which was one of the main authors' goals. Overall satisfaction with the tutorial is also high, with 56.6%.

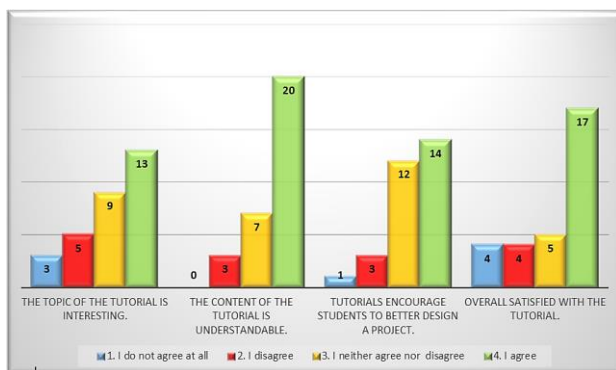


Figure 8. Results of the degree of agreement with statements about the tutorials

The last question, in which students could express their opinion and write a comment, demonstrates attitudes among students towards the tutorials. Eight students complimented CATAPEX without any remarks. However, eight students suggested that the authors should make more tutorials that will cover more APEX functionalities such as wizards, charts, calendars, master-detail tables, plug-in installations, etc. Other students did not comment on the tutorial through this question.

In the next section, the key conclusions of this paper are highlighted, the challenges that arose during the development and evaluation of the tutorials are listed, and plans for future improvements and further work on this topic are presented.

6. CONCLUSION

The main focus of this paper is development and evaluation of CATAPEX, the tutorial designed to

provide the necessary explanations and assistance to students in creating an application in Oracle Application Express tool. CATAPEX tutorial is composed of five education lessons in the Serbian language: Introduction, Creating Tables and Foreign Keys, Creating Forms and Reports, Creating a Navigation Menu and Creating a Home Page.

In this paper authors presented:

- Several characteristics of Oracle Application Express tool, which is used for application development,
- Database for the preschool institution "Radost",
- Structure and content of CATAPEX tutorial,
- Results of CATAPEX tutorial evaluation.

Based on the conducted evaluation and following the suggestions that students gave, further development will refer to refining the existing tutorials and adding new ones, i.e. by improving and upgrading lessons in the form of innovative lessons that follow the latest version of the Apex tool, adding new lessons related to creating procedures, modifying designs, etc. Knowledge and skills in the development of database application through Oracle Application Express can be gained using this tutorial not only by students from the Faculty of Technical Sciences Čačak but from other faculties as well. Also, the tutorial can be posted as a part of the courses on an e-learning site or on social networks such as YouTube, so that they can be accessed by a greater number of interested persons. Further, creating and publishing tutorials in English or some other language can be highly beneficial in terms of achieving a wider application of CATAPEX.

Based on the internal evaluation by the authors, it can be noticed that CATAPEX tutorial is very time consuming during video editing and narration rehearsing, which greatly affected the speed of its production. The most complex part during video editing is cutting out unnecessary content and synchronizing the video with the narration. The easiest part when creating a tutorial is the creation of the final "product" (production), i.e. saving the tutorial in the desired format. Future work will also cover consideration of applying some other less demanding screen recording tools.

ACKNOQLEDGEMENTS

This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, and these results are part of the Grant No. 451-03-68/2020-14/200132 with University of Kragujevac – Faculty of Technical Sciences Čačak.

REFERENCES

- [1] *Tutorial definition*. [Online] Available: <https://techterms.com/definition/tutorial> [Accessed Jul. 10, 2020]
- [2] Matovelle Fajardo, A.F. & Ordóñez Gálvez, J.A. (2012). *Tutorial de Oracle Application Express 3.2.1 (APEX) con Generación de un Sistema Prototipo Call Center*. Azuay University.
- [3] Baggia, A., Mali, A., Grica, A. & Leskovar, R. (2018). *Oracle APEX v visokošolskem izobraževanju*. 37. mednarodna konferenca o razvoju organizacijskih znanosti, Portorož, Slovenia.
- [4] Monger, A., Baron, S., & Lu, J. (2009). *More on Oracle APEX for teaching and learning*.
- [5] *Oracle Application Express*. [Online] Available: <https://apex.oracle.com> [Accessed Jul. 10, 2020]
- [6] Bottger, T. (2020). *Get started with APEX*. [Online] Available: <https://blogs.oracle.com/database/get-started-with-apex> [Accessed Jul. 10, 2020]
- [7] Coronel, C., Morris, S. & Rob, P. (2013). *Database Systems: Design, implementation, and Management*, Cengage Learning.
- [8] Elmasri, R. & Navathe, S.B. (2004). *Fundamentals of Database Systems*. 7th edition. Addison Wesley.
- [9] Rischert, A. & Morrison, A. (2003). *Oracle SQL interactive workbook*. Upper Saddle River. N.J.: Prentice Hall.
- Camtasia. [Online] Available: <https://www.techsmith.com/video-editor.html> [Accessed Jul. 10, 2020]