



UNIVERSITY OF NOVI SAD  
TECHNICAL FACULTY "MIHAJLO PUPIN"  
ZRENJANIN  
REPUBLIC OF SERBIA



VIII INTERNATIONAL CONFERENCE OF  
**INFORMATION TECHNOLOGY AND  
DEVELOPMENT OF EDUCATION**  
**ITRO 2017**  
PROCEEDINGS OF PAPERS



VIII MEĐUNARODNA KONFERENCIJA  
**INFORMACIONE TEHNOLOGIJE I  
RAZVOJ OBRAZOVANJA**  
**ITRO 2017**  
ZBORNİK RADOVA

ZRENJANIN, JUNE 2017

Publisher and Organiser of the Conference:

**University of Novi Sad, Technical faculty „Mihajlo Pupin“, Zrenjanin,  
Republic of Serbia**

For publisher:

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Printed by:

**Printing office Donat Graf d.o.o, Mike Alasa 52, Beograd**

Circulation: **50**

**ISBN: 978-86-7672-302-7**

By the resolution no. 142-451-2481/2017-01/02, Autonomous Province of Vojvodina,  
Provincial Secretariat For Science and Technological Development donated financial means  
for printing this Conference Proceedings.

**The Conference is supported by the Autonomous Province of Vojvodina**

CIP - Каталогизacija u publikaciji  
Библиотека Матице српске, Нови Сад

37.01:004(082)

37.02(082)

**INTERNATIONAL Conference on Information Technology and Development  
of Education ITRO (8 ; 2017 ; Zrenjanin)**

Proceedings of papers / VIII International Conference on Information  
Technology and Development of Education ITRO 2017 = Zbornik radova = VIII  
Međunarodna konferencija Informacione tehnologije i razvoj obrazovanja ITRO  
2017, June 2017, Zrenjanin. - Zrenjanin : Technical Faculty "Mihajlo Pupin", 2017  
(Beograd : Donat graf). - XIII, 290 str. : ilustr. ; 30 cm

Tekst štampan dvostubačno. - Tiraž 50. - Str. VI: Introduction / Dragana Glusac. -  
Bibliografija uz svaki rad.

ISBN 978-86-7672-302-7

a) Информациона технологија - образовање - Зборници b) Образовна  
технологија - Зборници

COBISS.SR-ID [315769095](#)

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*With this publication, the CD with all papers from the International Conference on Information Technology and Development of Education, ITRO 2017 is also published.*

# Customizable Mobile Components as Supporting Tools for Blended Learning

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**Abstract - Combining mobile technology to work on the go becomes very popular in the world today. The development of cross-platform technology enables easier and more effective way of access to mobile platforms by reducing costs and creating opportunities for productive collaboration. In this paper we describe four cross-platform components for blended learning intended for collaboration between students. The created programmable components allow cooperation through transfer of educational material, educational animated video content and shared environment for collaboration on a given task in a university environment. Test results for these components show considerable interest among students to use this type of tools. The proposed tools are flexible and can be edited as needed.**

## I. INTRODUCTION

The purpose of this paper is to present a model of customizable mobile components for advanced teaching and learning using smart mobile devices. Today, pupils and students mostly perform their school related tasks using their smartphones, tablets and smart watches. The younger population use mobile devices to constantly be active online, which opens up a huge opportunity for advanced implementation of mobile devices in the educational process. The use of mobile devices in the educational process in the classroom and outside of the classroom allows advanced interaction between students, it helps the process of distance learning, allows sharing of videos, learning through games based on mobile phone, educational materials with animated content, etc.

For this purpose, we have created four multi-platform mobile components that can be adjusted according to user needs. The components are designed for mobile platforms iOS and Android and can be used as separate applications or adaptable modules for implementation in other mobile applications. The first component refers to the distance learning and it is called “Online Learning” component. The second component relates to taking the tests using mobile devices from the pupil / student. The third component is

called collaboration component and provides modern interaction between teacher and students outside and inside the classroom through the exchange of educational materials and deciding on a particular task. The last component is designed for teachers and refers to the management of the previous three components.

## II. RELATED WORK

Different ways of applying modern technology in the educational process are presented in the literature. Many authors in their research papers are presenting different benefit from the applications of modern mobile devices and advanced technology into practice in the educational process. According to some authors, if mobile phones are used for education, they are getting a double benefit because the education bears out of the classrooms and carry social resources back in schools [1]. Additionally, in the literature there are authors who believe that the quality of the educational process in developing countries can be significantly increased by the application of advanced technologies [2]. Author Makoe concludes that the use of mobile devices in the educational process provides a significant contribution to education in developing countries because it allows access to information for the less privileged. [3] In several places in the literature there are mentions for the lack of will to implement these technologies in the educational process due to a fear that the process can be disturbed by mobile devices. The authors in [4] stated that they conducted a survey of a sample of 100 students which showed that the use of mobile devices in the classroom is still limited due to fear of teachers that digital devices will reduce the quality of education. According to the research in this study, students want to use mobile devices in the teaching process, but for the teachers there is a need for determine positive effects of application and presentation of a real practice prove about the positive income of these educational tools. The studies have shown that in practice often can be found informal

attempts for using mobile devices as alternative or helpful tools in the educational process.

### III. DESCRIPTION OF THE PROPOSED COMPONENTS

As it was mentioned above as part of this research we created four experimental programmable components designed for mobile platforms iOS and Android. The components are flexible and adaptable and can be adjusted by the user to meet his needs. In this section we will give detailed description of the four proposed components. All components are oriented for multiplatform use, written in combination of JavaScript and Flex technologies. For the purpose of this research we used Development Certificate for iOS devices. The proposed components are original and ready for implementation in different educational environments.

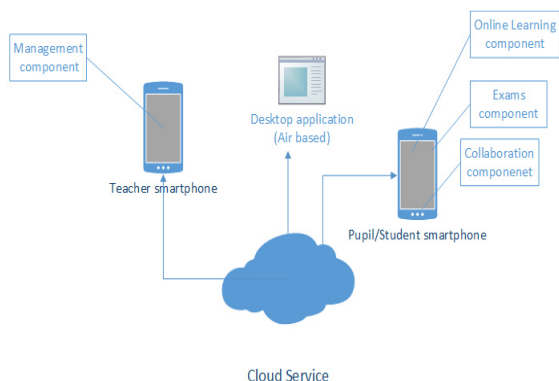


Figure 1. Visual representation of the implementation of proposed components

#### A. The Online Learning Component

The first component is called "Online Learning". This component integrates functionalities for monitoring webinars, electronic lectures, presentations and video content. The component includes special features designed for digital educational materials that contain animated content. The component is based on Adobe Air technology and it's adapted to be able to work with Flash animated content in the form of animated flashcards that are meant to be a substitute for the standard educational materials based only on text and static images.

We believe that this approach may be particularly useful for certain students such as medical students, who often needs to practically see what are they reading in form of animation to better understand the lecture. In order to activate the component and gain access to the created educational materials, it is required for the user to be previously registered with the IMEI code of the

mobile device in the database. Only registered devices have access to the content of this component. All user data and shared materials are stored in a cloud based server. It can be implemented using the most appropriate cloud solution implementation and also a solution based on a local server that will be in charge to serve the proposed components within this paper. For the purposes of this study we have used combined local Linux server and cloud based server implemented on Amazon Web Services (AWS) platform. The presentation of the functioning of Online Learning component is shown in Figure 1.

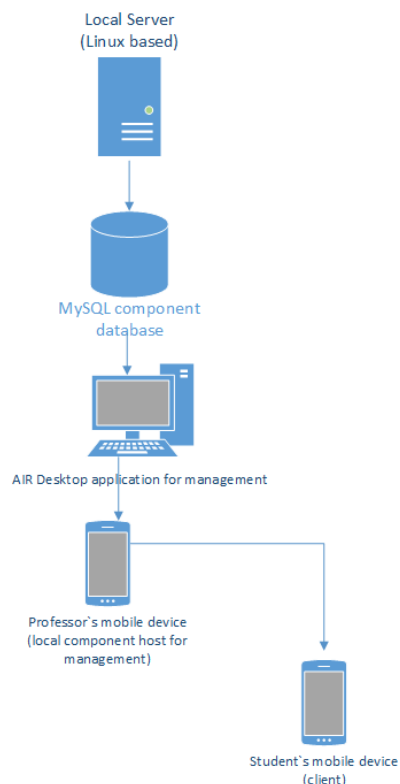


Figure 2. Schematic representation of the functionalities of online learning component

#### B. Exams component

This component refers to the possibility of implementing electronic exams using student's mobile devices in or out of the classroom in real time. To use this component, the user's device must be previously registered in the customer database in order to be recognized by the component. Testing is performed in two ways. The first way is based on questions with offered answers.

The second way is presenting questions, to which the user can give verbal answer. The component integrates the ability to record the obtained answers in the form of audio files, saving

them to the server and creating a hyperlink to them so they can be verified later by the professor. Figure 2 shows a diagram of the activities carried out with the help of this component.

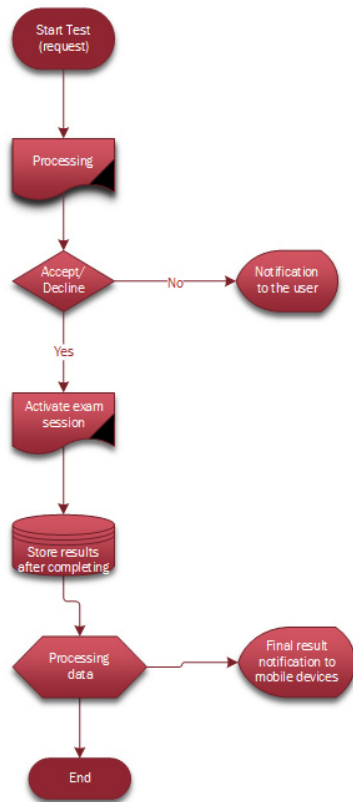


Figure 3. Exams component activity diagram

In order to receive questions and begin to take the test, users previously need to demand access by simply clicking the button "Start Test", after that it will open an input form for 6-digit code that will be provided to the user by SMS. To test the solution, we have used SMS provider. For the operation of the components we previously developed AIR based desktop application through which the safety components are managed. The request for the entry is sent to the mobile device of the professor, the professor through the inbuilt component for management can approve it or reject it. If he approves the request, so called "active session code" will be sent to the user, the code lasts 1 hour. During the specified time the student is obliged to complete the test. The duration of the code for an active session can be changed only by the professor using the desktop application. In case of test with oral responses, the professor will receive notification upon completion of the test on his mobile device and is obliged to check the received answers. The number of obtained points, the type of questions and tests are created using the desktop application.

### C. Collaboration component

The third component is called collaboration component. The objective of this component is that students can cooperate in a contemporary way to cooperate among themselves in the classroom and outside of the classroom. The component enables connectivity to social networks such as Facebook and Twitter and direct sharing of materials on social networks. The built in programming logic within this component allows monitoring of the activities of students in real time using a desktop application. Active Tracking module which is implemented in this component allows monitoring of the activities of the user. The user activities that are undertaken in the performance of a specific task are recorded as the log file on the server and are available for analysis of teachers in order to determine the errors that student made in solving the problem. This component offers the opportunity for group solving a specific task which can work a maximum of 8 students (this can be changed through the desktop application). The solutions to the problem can be exported in various formats (pdf, xml, and doc) depending on the needs, and can be directly sent by email.

### D. Management component

The final component is called a management component. This component is strictly designed for installation on mobile devices of the teaching staff. The idea of this component is to serve as a mobile controller of students work with the other three components. Using this component, teachers and other staff related users can create tests, approve requests for access to educational resources, create tasks for specific student or group of students and collectively to evaluate the achieved results. The setup of this component is performed using a desktop application that is designed for teachers.

## IV. DISCUSSION

The presented components were technically tested within two months. During the implementation of the proposed components which can be presented as mobile applications or to serve as a complement for mobile applications, it is important for the developer to be satisfied with the technical features, because than the components can be adapted easily to fit the needs of the end users. The components are designed in a way that can be directly installed on the mobile device as demo versions for testing. The tests of the technical characteristics have shown the occurrence of errors, during data processing from iOS tablet devices and some Android mobile devices. These errors are removed during the second phase of



testing. Because the components were multiplatform oriented, we needed more time to test the functional and technical characteristics of components in order to work equally on different operating systems and mobile devices with different hardware features. To enhance the functional and technical characteristics we used profiling tools for Air based mobile applications and cloud based services for application testing like AWS Device Farm to test the components with different mobile devices simultaneously. It is important to note that the components can be adapted to web-based interface in order to be used in the browser. The components exchange data with the server via XML and PHP data services. For us it was extremely important to design a functional solution to qualify the proposed components. The components were tested only with virtual users and have not been tested in a real environment.

For the full implementation it is necessary to test their practical value in real environment. During the winter term we conducted an online survey among students of the first year of Faculty of Philology, designed for this research. Survey question concerned the use of mobile devices as tools for education. About 106 students took part in this research by answering the survey questions. The results of the survey have shown considerable interest among students for the use of this kind of technologies. Most of the students said that they cannot use mobile devices in everyday educational process, although they wish because there is still no suitable material made for mobile devices. That was the main reason for making the first few components, which can be upgraded in the future.

## V. CONCLUSION

The use of mobile devices as educational tools is the future of education. Studies have shown that most students want to use modern technologies for

learning, because they are making the process more interesting, interactive and fun. In this paper we presented four multiplatform components for mobile applications based on Flex technology. In the future it is necessary to develop additional components and mobile applications that will be adaptable to the educational contents. The proposed components in this paper have experimental character, the aim was to investigate the practical possibilities of technology for creating modern educational tools.

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