Abstract—This paper describes the advantages of using mobile devices and the so-called active learning method in higher education. The authors use their methodological experiences to include m-learning in their teaching process, focusing specifically on higher education and engineering students. The paper also describes the authors' motivation for expanding the existing e-learning projects with mobile learning. The paper focuses on the development of an Android application through which one will examine the impacts of m-learning in the Computer science course taught at Subotica Tech.

I. INTRODUCTION

Today, countless mobile electronic devices offer easy connection to the Internet and its services. These devices include the smartphones, netbooks, laptops as well as numerous other devices that will make instant connection to the Internet using cellular-based portable hotspots and mobile broadband card or Wi-Fi. Parallel to this, the devices people using are becoming more and more capable: the boundaries between them and some desktop computer becomes more and more blurred: most of the functions are identical to those found in desktop computing platforms.

These mobile computing tools are active participants in one’s daily life proving themselves indispensable by providing access to tools for business, video/audio capture and basic editing, sensing and measurement, geolocation, social networking, personal productivity, references, and of course just-in-time learning.

II. RELEVANCE FOR EDUCATION

The New Media Consortium's 2010 Horizon Report [1] states the following: "The portability of mobile devices and their ability to connect to the Internet almost anywhere makes them ideal as a store of reference materials and learning experiences, as well as general-use tools for fieldwork, where they can be used to record observations via voice, text, or multimedia, and access reference sources in real time." There are a wide range of possibilities for better involving the participants in education with the help of these tools.

In the previous decade, one of the eLearning mottos mentioned countless times was the following: "learning anytime and anywhere, in their own pace, accessing online learning materials and interactions in any part of the day, etc.". Now this motto may be given a ‘do-over’, and set out with new wind in the sails.

This new form of eLearning or we can say its extension is called mobile learning or mLearning. From the [2] comes the following description about m-learning:

"Mobile learning, or "mLearning", offers modern ways to support learning process through mobile devices, such as handheld and tablet computers, MP3 players, smart phones and mobile phones.

It presents unique attributes compared to conventional e-learning: personal, portable, collaborative, interactive, contextual and situated, it emphasizes "just-in-time-learning" as instruction can be delivered anywhere and at anytime through it. Moreover, it is an aid to formal and informal learning and thus holds enormous potential to transform the delivery of education and training."

III. MOTIVATION

The motivation for this present project to use mobile learning lies in – wishing to extend existing eLearning projects which are already up and running at Subotica Tech (College of Applied Sciences at Subotica).

There have been several attempts to integrate e-learning into teaching English as a foreign language, two separate researches have been conducted in the fields of teaching and learning programming languages. Both are connected with the personalization of curricula. One is from the aspect of integrating the learning styles theory and the other is from the aspect of adaptive testing [3]. However, these eLearning projects have not only provided valuable information on how to implement these theories in education – but also how not to. These specific insights will be vital in creating better contents in the future. The goal is to find the causes of some of the previous project failures. Subotica Tech has been working in the past 4 years on running web project the ‘E-student’ [4]. It was developed for two reasons. First, it was meant to serve as an educational framework in which the student can do the following:

1. Read lectures in the subject of programming languages.
2. Check their own knowledge with a self-testing module.
3. Communicate with other participants of the course.
The second reason for developing this framework was to track students’ activities while they are “walking on the path of knowledge”. Those data are strictly connected to the person’s (student’s) behavior and learning styles and could tell much about his/her specific needs while learning in an electronic environment. Identifying specific needs is vital for ensuring a successful electronic experience. These needs, among others, the following: for a specific person which is the adequate structure of the lessons, which example or number of examples will best explain given technical terms, which method is optimal for communication between participants, or which environment settings are most important for the user, when he/she uses the framework, etc. All these could lead to curricula personalization. The goal of adaptive educational hypermedia systems implementing theory of personalization is to find alternative methods to the “one size fits all” approach, because only by satisfying student’s specific needs can result in optimal learning performances.

Collected data about how students have behaved in the E-student framework in use at Subotica Tech shows that students did not use it as the developers had originally intended. There is a great amount of data which has already been analyzed, for the purpose of this work only one aspect will be mentioned. By closely examining the logging time it became obvious that the students did not use the framework often. The times they logged in often coincided with the announced dates for tests and exam, i.e. shortly before these. From the aspect of collecting relevant and specific data about the user for building his/her model, having only the sporadic, non continual data is somewhat of a drawback.

Let it be assumed that the underlying cause for sporadic use of the E-student system was the fact that the students were not always close to a personal computer with Internet access. This deficiency can be easily corrected with their mobile devices. With those devices students have a tool which could easily replace the personal computer; it is constantly available and offers an option to access Internet.

Another peculiar aspect of mobile learning must be highlighted: by using it for learning content distribution, the teacher can engage the students on daily level. The authors’ assumption is that such continuous engagement might have positive effects on the learning process, because it would lower the effects of lack of motivation and feeling lost, which are very often present in an eLearning environment. Furthermore, a lot of researches proved that engaged students are successful students [5][6][7][8][9]. They earn better grades, have lower rates of attrition, and help their peers learn more. And finally, with the mobile devices and its capabilities the authors will finally have a tool through which the students could take an active role in their own learning process.

IV. THE PROJECT DESCRIPTION

This section will describe an android application which supports mLearning and can be used to check some of the previous assertions. Currently the application is still in its development phase and some of the options mentioned in this section are not implemented to date.

The application can run in two modes: the offline and online mode. In the online mode, the students will receive one MCQ type question on their device on a daily basis. This is an efficient method to make learning engaged and keep student continuously present in the topic. The downloaded question is taken from the field of the programming language C/C++. The students have time until the end of the day (midnight) to send back their answer to the server. The received reply, including the answer, the student’s ID, the response time, etc. allows the authors to perform further data evaluations. The downloaded question comes from the set of more than 180 questions compiled and selected by the authors. The set is also available in printed form, and the topics cover all of the theoretic parts from the curriculum for the given subject. Students can practice debugging, algorithmic thinking and check their knowledge of theory by solving these questions. Apart from serving practicing purpose, this question data base is in fact the source for mid-terms tests in this course. The MCQ form of the questions allows easy way to collect and process answers [3].

A. Online mode

The user interface of the application is presented in the “Fig. 1” below.

![Figure 1. Presented question and the possible answers in the application](image)

This application works as a widget. It periodically checks the server via the Internet, and if there is a new piece of data (i.e. a new question), it will download it to the device. The text of the question, the offered answers and indication as to the correct answer all come from the server in JSON format. The downloaded data is extracted and presented on the components of the user interface.
The student can click on the button offered (presumably right) solution. Clicking on the button the student checks the answer, which is visually presented by a change in the button’s icon and color of the text (Fig 2.) The user can check more than one button. After clicking on the send button at bottom (the one with the “Küldés” title,) student will send his/her answer to the server and the application displays the correct answer (hopefully, coinciding with the student’s choice Fig. 3).

This is the last step for the daily cycle of the engagement task. The application will continue to check if there is a new question on the server. On the next day, a script on server will make new engagement and it will be available for download.

Because on Subotica Tech the teaching is bilingual, the application has two ways of naturalization: one for Serbian and one for Hungarian language. The next picture (Fig. 4.) shows the application when the user has Serbian setting in his/her device. The changes in user interface are done automatically and are based on the device settings. No other languages are included, for example English, because the text of the question is on Serbian or Hungarian. If the user does not have Serbian or Hungarian setting at the device, the application starts with Serbian language questions.

In this phase of development the following options are yet to be implemented:

4. - Sending comments about the question. The student has an option to send not only the answer, but he/she can write a short note about the question, for example about its difficulty.

5. - Displaying explanation. In the case of wrong answer the application displays a short explanation of the solution.

B. Offline mode

In this operating mode, the device offers the option to browse all questions. This is done by displaying questions from the local database. The questions are previously downloaded. When this operation mode starts, the application checks the version of the database at the server and at the device, and if it is necessary, download will be initiated. The user interface is similar to that in online mode, but there are three new buttons for listing questions forward and backward and one for showing the correct answer (Fig. 5.). Similarly to the online mode, there are some options that are not yet implemented in this phase. Those options are:

6. Browsing the questions from the last viewed. Since in this version, the application always starts the new browsing from the beginning, this option will help to view all the questions in the set.
7. Random browsing. The questions are not always displayed in the same sequence.
8. Showing the results in the global questions set. The answers to all questions are summarized in one result.
9. Random quiz. This option will select a smaller set of questions and offer it in the form as it is done in mid-term tests.
10. Sending students’ results to the server.

Regarding this current project, results and experiences from the computer adaptive testing (CAT) application have proven of significant importance [3]. The data collected from the students in online mode could be used to help with the evaluating the question’s difficulty and categorize them based on their level of difficulty. The classification of the questions is vital for the IRT when choosing the “optimal” next item for the examinee.

Without feedback from the students, the teacher only assumes, for example how “hard” the question is, or is it easy to understand or not. Also, from the collected data, teacher can see dynamically, during semester which part of the curriculum needs additional explanation for actual generation of students. In the previous learning process the need for repeating some topics could be observed only by writing mid-term tests.

When analyzing data, we must calculate that some of the answers were given using the “help from the friend” option. But if we assume, that some kind of conversation is done about the question, and some kind of explanation is also given, this kind of social help we could identify as a form of consultations.

V. CONCLUSION
The application is still in development phase and its evaluation is expected in the 2014/2015 academic year. Apart from presented expectations and predictions regarding this project’s implementation, the authors summarize the pros and contras about mobile devices and mobile learning.

On the pro side one can list the following options: mobile devices are available 24 hours a day for accessing and processing data from the Internet or local database, thus they offer an opportunity for 24-hour learning. Using these devices in an electronic learning process, makes them a perfect choice.

On the contra side there are a few signs which point at some potential problems in using these devices for learning. For example, one of the problems is the fragmentation of information which is becoming increasingly difficult to decipher. Also, it has to be considered how text making for these devices with usually smaller display size will impact student literacy. The question has arisen about copy-paste option, because 24 hour access to Internet not only allows curriculum distribution, but also access to other people’s work or results.

While this current paper may not be teeming with a wide spectrum of tried and tested research results, it does address an important issue and tries to provide a solution. Since the unavoidable presence of electronic devices in the classrooms, the students’ learning styles and indeed, their entire approach to learning has changed enormously. The teachers cannot allow themselves to be unaffected by these changes, instead, they must provide new learning forms which better address the students’ electronic-
device-oriented world. Turning a “simple” smart phone into a learning aide, in fact, a source of learning-material-cum-testing-opportunity is an excellent example. The goal is not only to be seen as the teachers using “trendy” techniques, but to make the students more involved in their own learning process, preferably while being unaware of this. Future work will focus on the implementation already-indicated options which have yet to become active, as well as analyzing the received data and fine-tune the system based on those in order to provide students with an optimal learning electronic experience available 24-7.

REFERENCES