The experiences of setting up, developing and implementing a mobile learning project in Croatia

The SCOLLAm project

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Abstract — This paper problematizes the challenges of setting up a new mobile learning project in a Croatia, a country where technology-enhanced tools in classrooms are not often used due to a number of reasons, two of which are the lack of infrastructure and no teacher professional development. There are three focal points of this paper: designing scalable and durable mobile learning solution, working with teachers in order to ensure an adequate teacher development and creating appropriate digital contents to match primary school level 2, 3 and 4 curriculum. Scaleable and durable mobile learning solutions in the context of this project include two main platforms: (1) a mobile learning tablet application for primary school students and (2) a designer application mainly aimed at digital contents designers and producers, to also be easily used by the teachers. On the other side, it describes the processes of strengthening digital competences of the participating school teachers, including technology competence, leadership capacity and technology supported curricular innovation processes. Thirdly, the issues of design and implementation of digital lessons are explored with a special focus on digitalization of the existing non-digital lessons together with the teachers, wherever appropriate and feasible. As a result, conceptual prototypes of digital lessons are produced to be analyzed and discussed amongst teachers and researchers, after which the selected ones get integrated into digital lessons for tablet computer. In addition to describing the threefold process and the accompanying issues, the paper presents preliminary experiences and results in this novel research initiative, sets up mid-term goals and proposes and adequate methodology in achieving the project goals.

Keywords — mobile learning; educational technology; tablet computers; informal learning; mobile applications

I. INTRODUCTION

Introduction of innovations and new technology in a system that operates in more or less similar way for many decades is not an easy task. With other difficulties, such as lack of adequate infrastructure, scarce financial resources and insufficient professional development of teachers, there is a number of challenges to overcome in order to successfully implement a desired system improvement. Croatia is a country that still feels the consequences of war, economic transition and the recent global economic crisis. Many schools are poorly equipped, without sufficient number of computers and fast internet connection, which is one of the reasons why Informatics is still only elective course in all primary, and in many secondary schools in Croatia [1].

In September 2014, in such circumstances, a project to explore the potential of using mobile technology for seamless and mobile learning in Croatia was launched. Named SCOLLAm (“Opening up education through Seamless and COLLABorative Mobile learning on tablet computers”), this three-year project is one of the first scientific research projects closely related to mobile learning that is implemented in Croatian schools. SCOLLAm is building up on the experience of team members and in similar projects from Sweden, USA, and especially the Seamless learning project conducted by the National Institute of Education in Singapore [2]. The main goals of the project are: proposal and design of a technologically innovative, scalable and durable mobile learning platform, cooperation with teachers in order to ensure an adequate teacher development and their competences in the ICT and mobile technologies fields, and creation of digital content tailored for usage in the first years of primary school.

SCOLLAm research team is multidisciplinary, comprised of scientists from both, ICT and fields of teaching methodology and pedagogy. Together with school teachers and international e-learning and m-learning experts as a team consultants, SCOLLAm created a small mobile learning community, which, in addition to their work on the project, encourage and participate in the discussions on the modernization of teaching, and carry out various studies on the use of technology in everyday teaching.

In the first stage of the project focus was on the analysis of teaching methods and tools the teachers are using in their everyday work with students, estimation of digital and ICT-related competences and education level of teachers, and analysis of the current state of computerization in a typical Croatian classroom. In the second stage a prototype digital lessons will be created and tested. For this purpose two software applications are being developed: a mobile learning platform named SCOLLAm [in]Form, and a designer and player of digital lessons – [in]Form Author. Other parts of the system include collaborative learning, augmented reality, analytics and adaptivity modules, which will be, when finished, integrated into the [in]Form platform.
The rest of this paper is organized as follows: in section II the experimental school and project participants, together with some details about Croatian schooling system, are described. The research methodology is described in section III. Current status of the project, findings, issues and design decisions that had to be made are discussed in Section IV. Section V describes the work of the team members in improving the digital competences of teachers. Finally, Section VI concludes the paper.

II. PARTICIPANTS: FROM AN EXPERIMENTAL SCHOOL TO A NATIONAL LEVEL PARTICIPATION

The project is implemented in cooperation with elementary school Tržiška from Zagreb. It is a small school with around 25 mix-gender pupils per generation. The research focus is on the first four grades, with students aged 7 to 10 years. Elementary school education in Croatia is split into two four-year parts, with lower four grades, having one dedicated teacher for most of the subjects as per curriculum (Croatian language, mathematics, nature and science, music and visual arts and physical education) [1]. Members of the research team regularly attend lectures in all four classes, participate in field lessons, and organize meetings and consultations with teachers. Team members are monitoring and analyzing activities in the classroom, and suggest the possibilities of their “digitalization” or enrichment with additional digital content. Often teachers themselves propose their own ideas how to improve the existing lessons with simple mobile games or questionnaires.

In the autumn of 2015, a national-wide project named e-Schools starts in Croatia. The project that will last for next three years aims to computerize and equip about 150 Croatian schools with modern technologies, tools and teaching materials. E-Schools is a preparation for an even larger national informatization project that starts in 2019. The SCOLLAm team is actively involved into preparation of both of these projects, in fact SCOLLAm serves as a pilot to both. Results and experience from SCOLLAm will be used in planning these and other Croatian educational system computerization projects in the future.

III. RESEARCH METHODOLOGY

The research methodology of the project is based on the Design-Based Research (DBR) [3][4][5] approach. It is an approach that combines theoretical and empirical research in education, giving better insight why and when a certain intervention in educational process gives a positive outcome. The whole DBR process is iterative, starting with predefined learning goals, through a series of iterative “design – develop – implement – test – analyze - redesign” cycles, resulting in a design principles and theories closely linked to the context in which they are applied [5].

Through a series of stages the researchers of the SCOLLAm project are iteratively collecting information and gaining a better understanding of the seamless mobile learning system implementation. Fig. 1 gives a deeper insight of stages in the project research and development process. On the basis of observed lessons the conceptual model and lesson description documents are created. These materials are input into the next stage, the identification of digitalization opportunities. Together with teachers, the researchers from both pedagogical and ICT field suggest and design prototypes of new “digitalized” lessons. Lessons are then iteratively evaluated and modified, and finally integrated into the SCOLLAm [in]Form platform (Fig. 2).

The platform itself is client-server based. According to Parsons & Hokyoung [6] this seems as the most flexible and popular solution for mobile educational applications.

IV. DESIGNING MULTIPLATFORM MOBILE LEARNING SOLUTIONS

SCOLLAm builds upon a number of educational projects
carried out by team members in the past, that included work with primary and secondary school children [7], university students [8], as well as people with specific communication needs. For most of these projects custom mobile applications were developed, but the solutions were generally platform-specific. For instance, the mobile social learning platform SamEx [7] was developed only for Windows Phone, preventing it to reach a large number of Android and iOS users.

In the early stages of the SCOLLAm project, various single platform tools to extend SamEx’s functionalities were developed for Windows Phone and Android operating systems. The code was also platform-specific, often duplicated and thus hard to maintain and further developed, especially when additional operating systems are concerned. With that in mind, in this project the goal was set to develop a single - integrated mobile learning platform. The platform is intended for two categories of users: primary school students and their teachers - who are also content designers. For the content generation part, a single web application named “[in]Form Author” (Fig. 3) is developed. It is used from the desktop computer, via internet browser, to design and generate lessons. Lessons are saved in JSON format (with additional media files), packaged, and subsequently deployed to the students’ mobile devices where they are executed via mobile application module named “Player” (Fig. 4). Apart from Player, the existing SamEx code-base is used to include the support for collaborative learning, badges, experiences etc. in our mobile learning platform. Unfortunately, SamEx code, written in C# was available only for the Windows Phone platform, and the project objective is to support all three major mobile platforms.

In terms of user experience and speed, the best approach would be to develop separate parallel applications for all targeted platforms [9] [10], but that yields duplicate code in different programming languages, intertwined with platform-specific API calls. Such approach requires significantly more resources for development and, equally important, long-term maintenance and development of our application and was assessed as not appropriate in our case. The alternative is to abstract the mobile platform differences, that is to use cross-platform mobile development approach, where a single code base would be maintained. Though it is apparent that 100% write-once-run-anywhere code base cannot be achieved in this project because certain advanced mobile device’s capabilities (augmented reality, shared canvas drawing, etc.) are required, the goal is to maximize the common code base and provide the platform specific code only when it is necessary.

There are three main types of approaches to cross-platform development [11] [12]:

Pure web applications – application is written in HTML and related technologies (CSS, JavaScript, etc.) resides on the server, and is accessed via internet browsers on the respective devices. Applications are typically CSS-styled (e.g. jQuery Mobile) to mimic the look-and-feel of the native applications.

Hybrid applications – also written in HTML but are embedded inside a thin native container (e.g. WebView in Android, UIWebView in iOS). They are also executed by a browser, though it may not be apparent, being that the browser is integrated in the native application.

Compiled or interpreted applications – applications written in a single programming language and then converted and compiled into native applications for each targeted platform. Unlike the previous two approaches, the resulting applications are true native applications. However, frameworks in this category vary in the level of support of generic UI, that is – sometimes it is necessary to define separate UIs for different platforms.

Pure web applications were not an option since they lack the hardware and data access on the mobile devices, and therefore only leading hybrid and generated (compiled and interpreted) frameworks were considered: Titanium1, open-

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1 http://www.appcelerator.com/product/
source Cordova (ex PhoneGap)\(^2\) and commercial Xamarin frameworks\(^3\).

Titanium, though being a high-quality mature development framework, was discarded because of the limited Windows 8 support, and only Cordova and Xamarin frameworks were evaluated in further detail.

Both Cordova and Xamarin seem as an acceptable solutions, with Cordova having the advantage of being free, while Xamarin has a better technical support and a state-of-the-art development environment (Xamarin leverages Microsoft’s Visual Studio). Cordova also uses more widespread and open technologies (HTML5+JavaScript) when compared to Xamarin’s C\#. What tipped the scale in our particular case, is the ability to leverage the existing legacy C\# codebase and the excellent Xamarin’s IDE and more integrated environment. Also, Xamarin enables us to nicely structure the project and separate the generic views (through Xamarin iOS and Android projects), as it enables to mix-and-match those approaches\(^4\).

The Player part of our learning mobile solution, which is a packaged web page and data, will be executed through native web view container, as hybrid approach is employed in that part. At the time being, the complete legacy code with additional features is ported to Xamarin framework and most functionalities are covered with single code-base generic forms which greatly facilitates maintenance and further development. Xamarin has proven to be a right choice for our particular project.

V. STRENGTHENING DIGITAL COMPETENCES OF TEACHERS

The teacher development and strengthening of IT competences among teachers is, besides mobile learning platform development, one of the most important parts of the project. For that reason, the team members constantly cooperate with teachers, discussing lessons design, the development of the educational tools, but also discussing privacy, security and safety issues and concerns some teachers and parents have. Team members and teachers who are a part of the project participate in various events related to the development and planning of the future Croatian education system, attending different informal and formal educational meetings and conferences. In addition to discussions about the possibilities of using tablets and other technological tools in everyday teaching and as a part of ongoing efforts to improve their IT competences, the teachers attended The Carnet Users Conference\(^5\), a leading Croatian IT and education conference, which took place in Zagreb from 19th to 21th November 2014. A BoF (birds of a feather) session on the topic "What should we do with the tablets in the classroom?" was organized by team members as part of the same event.

Additionally, course on internet safety and cyber bullying by Kidscape\(^6\) was organized for team members and the principal of Trnjanska elementary school. Similar lectures and discussions for parents are also planned.

VI. CONCLUSION AND FUTURE WORK

In this WIP study the current state of one of the first mobile and seamless learning implementation projects in Croatia was presented. Based on the previous experience in similar domestic and international projects, the SCOLLAm project aims to go few steps further, offering the complete mobile learning platform, digital lesson authoring tool, collaborative and augmented reality modules, adaptation and analytics. The project is entering the second phase where the mobile learning platform and a range of additional application modules will be developed, and tested in the pilot school. In the end, the research aims to propose technologically innovative mobile learning solution, together with system architecture, a number of digitalized lessons, experimental modules, different insights and good practices that were identified during the project.

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\(^2\) https://cordova.apache.org/  
\(^3\) http://xamarin.com  
\(^4\) http://xamarin.com/forms  
\(^5\) http://cuc.carnet.hr/  
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