



Research Article

Connecting School Actors using Mobile Applications

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Abstract

Communication between the different actors present in the school ecosystem is an essential issue. However, in a busy world where parents do not have much time to visit schools regularly, it is crucial to create mechanisms to better monitor student success and school demands. The current pandemic situation caused by the coronavirus has highlighted the role that technologies have in supporting the mission of schools and communication between the various school actors.

The interaction between school, students and parents presents a growing and complex challenge. Technology has, in recent years, shaped the concepts of support and monitoring of learning - at school and outside it - as well as the way in which information flows between all actors in the school ecosystem. Emergently, the evolution of mobile applications, combined with the evolution of the capabilities of mobile devices, has enabled the creation of new and more effective intercommunication mechanisms, with ubiquitous approaches and in a predictable scenario of less willingness for physical interaction of the different actors. Based on these premises, this article reflects on the potential of mobile devices and their applications to support new models of intercommunication between parents or school sponsors, students and teachers. In this sense, a conceptual model is proposed that represents a work in progress that aims at creating and evaluating a prototype system capable of improving intercommunication and the overall success of the societal challenges of the school learning system.

Keywords: conceptual model, mobile devices, mobile applications, school ecosystem, education

Introduction

The use of Information and Communication Technologies (ICT) is changing organizational systems and the way they respond to their main actors' needs. In the school ecosystem, where is what we can name "the base foundations of society", the developing of appropriate solutions becomes even more fundamental. Society daily routines are increasable demanding – teachers need to face the constant developments of knowledge and how to pass it on to students; students are starving for more suitable and innovative solutions for learning and express their needs, back to the school ecosystem; parents/sponsors of education have less time to monitor the performance of their students and respond to requests from school (like they physically do in the past). This new reality forces for new ICT based proposals for the school ecosystem that can respond to their needs and expectations.

Mobile devices, mainly smartphones, are embedded in people's daily routines and represent the most common and widely used technology today. Smartphones are the most popular technological gadgets that have modified the face of communication and conduct to an irreversible impact on the psychosocial behavior of consumers (Alsayed, Bano & Alnajjar, 2019). This suggests that educational level is not a severe barrier to their use. The increasing number of features such as Internet connection, big screen, high processing capacity and modern computers-human interaction technics, have made the smartphone a technological device upmost suitable for running applications for multipurpose tasks in a fashion easy way.

According to Ersoy-Babula & Babula (2018), experienced teachers who adapted to Virtual Learning Environments (VLE) should have taken advantage of new mobile technologies to produce active learning outcomes. Also, students are today a massive group of mobile devices users. Thanks to the popularity of mobile devices, mobile learning has become a great tool for delivering educational resources (Paulins, Balina & Arhipova, 2015). Mobile devices

provide opportunities for students to access learning-content and to interact with teachers and other students wherever they are located (Gikas & Grant, 2013). Mobile learning and mobile-based pedagogies have in recent years increased in interest regarding their benefits and constraints in the teaching and learning process (Burden et. al., 2019).

In what concerns parents, many times, they have difficulty in understanding where the line lies between the constructive use of digital technologies that can support their children's learning, and the negative use of these devices – unhealthy use of technology (Papadakis, Zaranis & Kalogiannakis, 2019). However, research made by Özdamliv & Yıldız (2014) focuses on the importance of mobile technologies in school family cooperation process confirming that parents' opinion is generally positive on the educational purpose. Also, parents' working duties and availability for using technologies for personal advantage purposes on their job schedule make mobile devices, like smartphones, the most suitable tool to develop interactions with their children's schools, by their ubiquitous capability in accessing school information and services.

The considerations set out above were largely evident in the pandemic situation caused by the coronavirus. This reality triggered the need for a quick and effective response to make the interaction between different school actors digital. This reality reinforced the need to embed technology more forcefully in school processes.

This paper explores the potential of using mobile applications to support intercommunication strategies among key actors in the high school ecosystem, contributing to a better communication among these actors, as well as better monitoring of student performance by their parents or sponsors of education. After an overview of the state of the art regarding technological aspects that have been introduced into the school ecosystem, a conceptual model is presented and discussed. This work, being a work in progress, aims at the creation of a prototype

system that, once implemented, will be evaluated.

Literature and Existing Mobile Applications Background

Above is made a literature overview about the use of ICT in the interaction among school actors using major citation index databases and analysed the functionalities of thirty related Android applications.

Literature background

Several studies show that ICT can promote and leverage the interaction among school stakeholders, particularly, but not only, teachers, students and parents. In an article about engaging parents through better communication systems (Kraft, 2017), the author argues that “Digital technology must be an integral and purposeful part of schools’ communication infrastructures” since mobile phones are used by almost every adult from every socioeconomic level and, as such, texting and mobile applications could be used to easily connect schools and families of all backgrounds.

The use of ICT in school context, with focus on mobile devices and applications, can be explored at different levels. Messaging is an obvious one, can be done automatically or by request, to a group or to a single individual. But also, resource sharing, payments, reports, registrations, calendars and schedules, information search, student monitoring and transport tracking, to name a few. In fact, a lot of research is going on this subject and, following, we present some different approaches.

Sumathi, Umarani, & Abinaya (2017) present a mobile application for interaction with a centralized student information system to be used by parents, students and faculty members for effective communication among them. Each type of user accesses a well-defined module with specific purposes, like lecture notes, announcements, attendance and academic performance and discussion forums. The system was developed using XML, Java, MySQL and PHP.

An electronic booklet has been introduced as a new way of collaboration and communication between schools and families (Abreu, Rocha, & Cota, 2015). Most

of the teachers and parents questioned expressed interest in the adoption of that tool, thinking that it could have more advantages than the traditional one, in paper format, improving the communication process between them, since it allows “Faster, more efficient and safer communication” and “Customized access to information, at any given time and place”. The electronic booklet would be a responsive web application, replicating the functionalities of the paper booklet as an improved direct communication channel between teachers and parents.

Also, for students that need attention related with their health, the use of mobile phones can be beneficial. A smartphone-based system has been developed to help autistic children (Chuah & Diblasio, 2012). The sensors embedded on smartphones were used to correlate environment data (e.g., audio background) with stereotypical behaviours of autistic children, sensed by the accelerometer, allowing not only to alert the teacher in case of the occurrence of that behaviour, with intervention instructions based on the behaviour type, but also to prevent those behaviours, alerting when some environment trigger is detected. And, in countries where recommended vaccines are received through school-based programs, SMS reminders to parents/guardians could bring higher levels of vaccination uptake (Tull et al., 2019).

To monitor children during school bus transportation, there are several solutions using different technologies. For example, Radio Frequency Identification (RFID) tags to detect children and SMS to notify parents (Shah & Singh, 2016) or Bluetooth Low Energy (BLE) to identify the student and a mobile application for the parents to track their children in real-time (Pratama, Zainudin, & Yuliana, 2017).

Existing Mobile Applications Background

To get a sense of the available mobile applications related to our work and the features provided, we made a search on Google Play, the official app store for Android, the most used mobile operating system (76% of the market share according to StatCounter, 70% according to NetMarketShare, in July 2019). Searching

for the words "school" and "parents" returned about 250 results. However, some of them were the same application but customized for different schools. After that, we selected a sample of thirty different apps that offered the possibility of communication between the school and the parents and analysed their description and

their website, when accessible.

Table 1 shows the key features of those applications and the number and percentage of applications that provide them. Others can exist but they aren't explicitly announced on their description or on their website.

Table 1 – Main features of the mobile applications

Information / News	28	(93%)	Social	11	(37%)
General information/news	28	(93%)	Photo Gallery (activities)	9	(30%)
Teaching activity	21	(70%)	Internal Social Network / Forum	2	(7%)
Absence consultation/notification	19	(63%)	School transports	10	(33%)
Schedule	15	(50%)	Transport localization	10	(33%)
Homework (consultation)	12	(40%)	Student localization	6	(20%)
Important events (exams)	11	(37%)	Chat system	3	(10%)
Grades	11	(37%)	Reports	10	(33%)
Summary consultation	5	(17%)	Individual Progress Reports	9	(30%)
Absence justification	1	(3%)	Daily Reports	2	(7%)
Homework (submission)	1	(3%)	Administrative Issues	8	(27%)
Messages / Notifications	19	(63%)	Personal data	5	(17%)
Receive from school	19	(63%)	Permissions	3	(10%)
Send to school	6	(20%)	Student ID	2	(7%)
Read receipt	1	(3%)	Pre-Enrolment (school, social support)	1	(3%)
Accounting	14	(47%)	Extracurricular activities (registration)	1	(3%)
Balance Inquiry	14	(47%)	Forms	1	(3%)
Payments	5	(17%)	Meals	2	(7%)
Invoice and Receipt Inquiry	2	(7%)	Menu consultation	2	(7%)
Calendar	13	(43%)	Reservation	1	(3%)
Events	11	(37%)	Attendance	1	(3%)
School calendar	3	(10%)	Health	1	(3%)
			Clinical data (allergies, etc.)	1	(3%)

As we can see, most of the applications focus on topics related with general information/news, teaching activities and messages/notifications. However, when we compare those topics in more detail, we can see that functionalities provided among applications are not homogeneous. Even more notorious is the asymmetry on the directionality of the communication flows. In fact, the vast majority don't allow parents to interact with school. For example, there are 63% of them who allows absence consultation and/or notification, i.e., from school to home, but only 3% of them allows absence justification, i.e., from home to school. The same happens with general messages/notifications, where the parents can receive messages from school in 63% of the apps but can only send in 20% of them.

In our opinion, there is an opportunity to develop new systems allowing better integration and interaction of the school ecosystem actors, capitalizing on the ubiquity of mobile devices. Considering this, following we will propose a conceptual

model for such system.

Also, we think there is space to explore innovative ways of interaction between parents, students, teachers and school staff using different technology solutions, but that will be explored in future work.

Conceptual Model Proposal

This research work was carried out under the Design Science Research (DSR) methodology, with the objective of producing knowledge that can be applied in solving real problems (Aken, van, 2005), which constituted a process to design artefacts, evaluate and communicate the results obtained (Çağdaş e Stubkjær, 2011).

From the first stage of the process, Taking Awareness of the Problem, resulted the proposal of this research work, seeking to respond to the need to streamline communication in the school ecosystem (teachers, class directors, students and sponsors of education).

Based on the awareness of the problem, and

on a second stage of the DSR process, came as suggestions: to propose the development of a system based on information technologies. In this context, the functional requirements were considered and led to the development of diagrams that specify the application.

In the future, it is intended to continue the research work, concluding the implementation of the system, making its assessment when being experienced in a case study, as well as reflecting and continuing to disseminate results.

Conceptual Vision and Model

The system we propose aims to be a facilitator agent at the communication among several school actors, including teachers and other school staff, students and parents/students' sponsors of education. The proposed model intends to be supported by the integration of server-side technologies with mobile devices applications to deliver information and services to the identified actors, according to Figure 1.

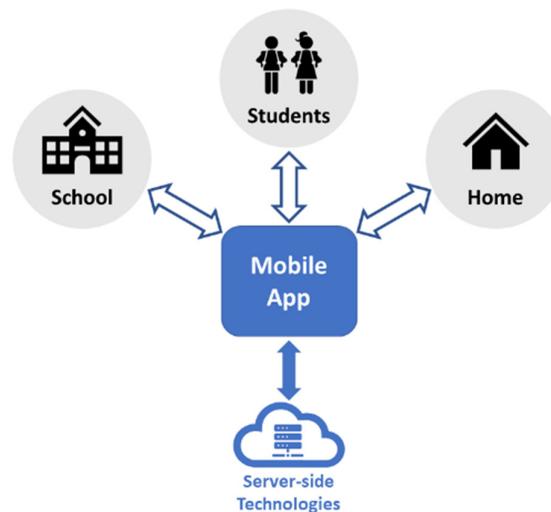


Fig. 1 - Mobile app connecting school actors

Assuming the increasingly ubiquitous role of mobile devices, it seems natural to choose a mobile app as the unifying element of communication between the main school actors. Although we recognize that other school stakeholders would benefit from their integration with this system, right now, our primary focus aims at boosting the interaction and strengthening the cooperation between teachers and class directors, students and their sponsors of education.

The mobile app would be supported by server-side technologies, for data processing and storage, and should allow for both online and offline functionalities as well as synchronous and asynchronous communications. Also, it would be beneficial to provide, wherever possible,

bidirectional functionalities to encourage interaction between the people involved.

Following, we intend to present and describe some functional aspects of the proposed system. For this, we use UML Use Cases diagrams to identify the functionalities of the system, the actors involved, and the role that each actor has in the system.

School Functionalities

The school activities supported by the proposed system are identified in the use case diagram shown in figure 2, focusing essentially on the actors: teachers and class directors.

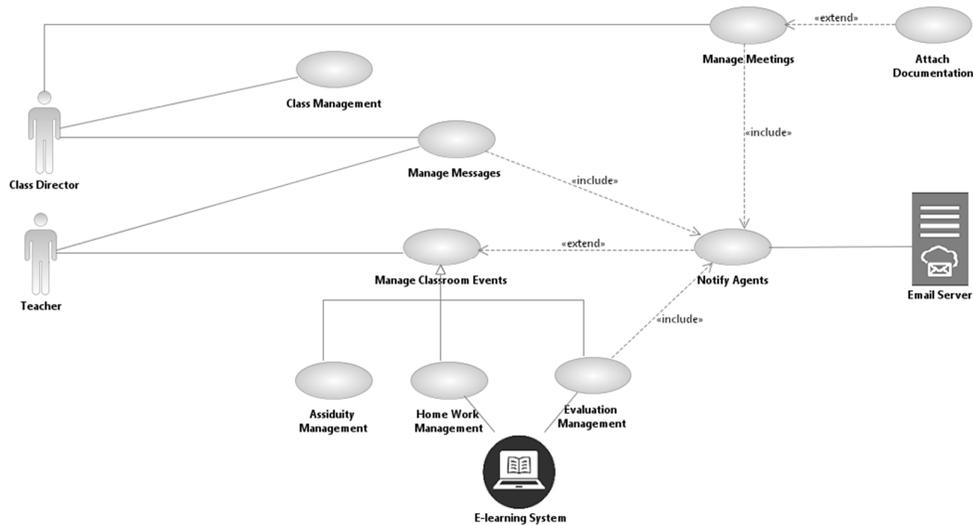


Fig. 2 - Use Case Diagram "support of school activities"

The management of the class is the responsibility of its director, whose function is supported by use case class management. The class director may schedule meetings, and for this purpose he or she may share documents.

The teacher is responsible for the management of classroom events, such as: absentee reporting, homework scheduling, scheduling of assessments, reporting of

grades, among others. The system also allows agents to exchange messages or notifications.

Home Functionalities

Figure 3 shows the use case diagram with the main functionalities provided by the system, especially focused on the parents or guardians (sponsors of education) and the monitoring of students' academic activities.

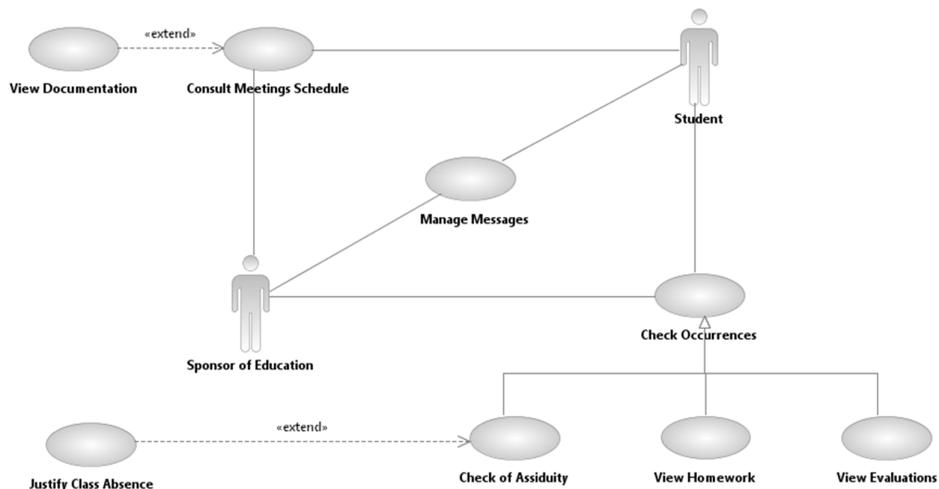


Fig. 2 - Use Case Diagram "academic accompaniment of the student"

Both agents, students and sponsors of education will be able to check the occurrences previously registered by the teachers, consult the scheduling of meetings and consult and send messages.

As can be seen in the diagram, the system also provides a functionality that will allow communicating the justification of absences to classes.

Discussion

The creation of technology-based mechanisms to interconnect the main actors of the school-system is, in our opinion, in a growing trajectory that can't be denied. The expectations of the young students of the generation Z and the recent generation Alpha, who were born surrounded by technology, Internet access and who consider an extension of their body mobile devices such as smartphones, will force that researchers and/or technological enterprises that design and develop technological solutions reengineer their solutions. To Provide innovative tools for supporting the interaction among the various school actors is a today need, and a growing one.

For parents or sponsors of education, the modern dynamic of their daily routines (and school's routines also) represents a new challenge in what concerns the correct accompaniment of their students. Also, for them, innovative solutions that manage properly their digital illiteracy, that in some cases still remain, and enable monitoring the most important aspects of the education process, are of utmost importance.

For teachers, that also are leaning innovative approaches to interact with students in what concerns the teaching and learning process – either at universities during their degrees courses and/or in various formations that they attend during their teaching careers) – it is crucial to develop solutions to enable a better accompaniment of their students in classroom and out of classroom. Also, because students in high school typically are underage, it is very important to have access to solutions that enable teachers to interact with students' parents or sponsors of education.

The development of technological solutions to help the above needs should be, in our opinion, designed as a whole (without excluding that collateral tools can be used) with available features varying according to the educational level of the student.

The proposed conceptual model tries to respond to the main needs of the three most important actors of the school ecosystem – students, teachers and parents/sponsors of education. The main goals are: increasing the communication, monitoring and exploring innovative school approaches, based in mobile devices applications, most aligned with the Z and Alpha generations.

Conclusion and Final Remarks

The school ecosystem is constantly changing thinking and needs. New teachers yearn to apply new teaching strategies; new generations of students see technology as a mandatory tool; parents/guardians are desperate for more appropriate solutions due to lack of time to accompany their learners and interact with schools. This reality requires new solutions to be developed to meet these new challenges. Accordingly, the development of integrated and ubiquitous solutions is the way forward.

This paper starts framing the reality of school ecosystem, reviewing the potential of using mobile devices applications to support an integrated information system to support a more suitable intercommunication among students, teachers and parents/sponsors of education. We have also overviewed the state of the art with a mix strategy – papers analysis among several bibliographic sources and a search and analysis of several Apps available for, any part of, the school ecosystem. After, we have proposed a conceptual model, focused on the three main school actors – teacher, student and parent/sponsor of education that we have discussed based on an integrated-actors approach and their main intercommunication needs. For future work, we are starting the development of a prototype system that we intend to test in a high school class, with their teachers, students and parents/sponsors of

education.

Embedding more technology in schools and a better exploitation of the use of mobile applications may, in our opinion, better prepare the school ecosystem to respond to the current and future challenges that lie ahead.

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