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Design and Development of an Educational Mobile Application to Optimize Communication and Interaction Between Members of Educational Institutions in Real Time

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ABSTRACT

The objective of this research is to optimize the communication and interaction between members of educational institutions, using a mobile application to improve service quality of the institution. By using the database with the information collected by the institution, as an important source for the integration and collection of education sector information, each institution is considered as an entity; it could be said that all the people who interact with it are the population, which needs to be connected and communicated with each other to subsist. Based on the exposed premises, a mobile application is designed to gather all users that interact with the same institution in a single platform. Thus, users are connected and communicated with each other by determining specific roles, which will have specific functions enabled for each type of user.

Keywords: mobile application; mobile system; Cloud; Cloud Messaging Firebase.

INTRODUCTION

The idea of developing an application arose from the intention of improving communication and interaction between the members of an educational institution to bring them closer together so that they can interact more effectively for their own benefit and for that of their institution.

Part of the motivation for conducting this study was to enhance students' academic performance by improving basic but fundamental processes for educational institutions, such as communication and interaction between its members. Should those involved in the academic development of each student be brought closer to such an extent that they are able to advance towards academic goals, academic development would be more likely to be as expected and optimal for the student's education, as interaction would be personalized and increasingly closer.

In order to propose a possible solution to this problem, kindergarten, elementary and secondary school students, parent and teachers were surveyed. The responses obtained revealed the aspects to be improved, ranging from homework assignments, to personalized question answering, to attendance and performance report cards, which should be accessible at any time; it was also revealed that parents are not usually notified when an assignment or a grade has been given, mainly because students do not inform their parents, creating a gap between students, parents and teachers. For all these reasons, we propose a mobile application that adapts to the needs of the educational institution, minimizes the gap and, at the same time, optimizes communication and interaction. Another important aspect is that

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it will also be aimed at parents and teachers, most of whom are not familiar with new technologies (Muñoz et al., 2015), which is why we propose a user-friendly and easy-to-use mobile application. The proposal attempts to bridge the gap between people from the same institution, through the intuitive and easy use of a mobile application whose main pillars are communication and interaction (Paredes-Parada, 2019).

This mobile application must be different from the tools used today, such as messaging applications, in which assignments and/or tasks are lost among countless messages or where everything is placed in a single chat room (Herrera & Buenabad, 2013). The necessary tools must be provided for education to be the optimum, as well as assistance in the most basic activities to improve student learning (Gértrudix & Barroso, 2016).

Human beings are sociable by nature and need to know, investigate and be informed, so much so that communication has undergone several changes concerning methods, types and methodologies; large-scale studies show that both information and communication are vital to achieve significant changes in the life of human beings (Molina et al., 2015). Communication is no longer only done verbally, orally or in writing, because now technology provides human beings with connectivity and interconnectivity allowing them to visualize images and to hear sounds in real time, which is applicable on a global scale (Cataldi et al., 2012). In recent years, interconnectivity between people around the world has increased in almost all sectors of the population and at all socio-cultural levels, thanks to the use of technology and the proper management of tools such as mobile devices called "smartphones", which every day are acquired by millions of people and used mostly for communication and information worldwide thanks to the internet (Gomez et al, 2016).

The aim of this research project is to optimize communication and interaction between members of educational institutions, i.e., to make the teacher-parent, principal-teacher relationship more open and meaningful, using mobile devices. Educational institutions integration achieved using mobile devices for teaching and learning is gaining momentum. Villalonga and Marta-Lazo, 2015 mention that in order to successfully carry out each stage of their learning model, certain already consolidated tools such as Google Drive, Facebook, Twitter, etc. must be used; the authors state that these tools must be used separately for each module of their learning model, this must now change since these functionalities can be included in a single app and fulfill the functions that they perform separately. As real statistical data were

available after conducting surveys and having ordered data, two roles were defined: that of teachers and that of students. Both groups were interviewed to learn about the reality of educational activities, and the results obtained were encouraging; questions were asked about their type of mobile device, the company contracted, the most frequently used applications, the cost of the network, frequency of phone use, etc. (Mendoza, 2014). These data are very useful for any type of research concerning modern education, as they allow observing how the bases are being formed to face a new stage in education in a more technological and systematized way (Cataldi et al, 2012). The use of mobile devices as a tool that serves as a mediator between teaching and learning should be seen as an opportunity to add value to education (Mendoza, 2014). This paper focuses on the use of mobile devices to optimize communication and interaction among members of educational institutions.

The communication gap that exists between the people involved in educational institutions is a recurring problem in educational institutions at all levels in the country due to numerous factors (Arias, 2015). At present, managers use means of communication such as ballots, control notebooks and memos, with which educational institutions try to address this issue, yet it is done in such a conventional way that favorable results are not observed. Therefore, we develop a mobile application to optimize communication and interaction among the members of educational institutions, which demonstrates the use of technology as a working tool that can contribute to improve interaction at the educational level.

The steady growth of mobile devices over the last two decades drives us to look for ways to add value to this tool that almost everyone uses to communicate and remain connected to the world. People always carry these devices everywhere and are attentive to all notifications they receive from different applications. What would happen if one of these notifications was an assignment that your child has to submit within two days or if it was an urgent meeting, a grade or a notification of the student's absence? Parents or guardians would not have to wait until they get home to find out what happened to their child during the course of the day. Parents or guardians should be informed of all their child's activities at school, so that they can follow up on their child's progress. Technological advantages make it possible to design a tool that brings parents and/or guardians closer to the institution in an attempt to reach harmony. The limitations identified in this study were difficulties in finding institutions to implement the model,

and the automation of processes to standardize the behavior of educational institutions.

Educational-Communicative integration model of mobile apps for teaching and learning

Educational activities are divided into 2 processes: learning and teaching. New methodologies that benefit those involved in educational activities are intended to be created using ICTs, which have been on the rise in recent years, and the culture of innovation. Villalonga and Marta-Lazo (2015) show the way teaching and learning activities should be; they maintain that it is necessary to adopt a system of dialogues based on horizontality and bidirectionality where communication is key, i.e., communication between the members involved in these activities must be clear and consistent so that everyone benefits from it. They further point out that the active participation of the members, as well as cooperation and interactivity, will ensure that the teaching and learning activities are efficiently performed.

Based on the learning model of Villalonga and Marta-Lazo (2015), we intend to give way to technology with the use of mobile devices accessible to users of all educational levels. In order to better understand the approach of the learning model by means of a mobile system, an in-depth knowledge of the pedagogical functionalities of educational institutions is required; this learning model is based on the knowledge imparted not only by teachers, but also by any other person who provides information on a specific subject. Knowledge is under construction and, as it is interconnected among members, it enables the network to build itself and become increasingly complex. During the research on how to solve a given problem, the student accesses contents that this model records and clearly shows, and even shows the tools that can be used to make the knowledge concrete. Data, once accessed, is connected with that of peers and teachers, so that the learning network grows efficiently, allowing information to circulate and interact with the users. It then must be transferred to a mobile platform that provides connectivity, a simple term that allows the model to be more efficient, considering that the mobile applications will be connected and the participants of each subject will be able to learn and teach according to the culture of innovation offered by technology (Villalonga & Marta-Lazo, 2015).

Mobile devices in higher education and personalized learning environments

To understand the direction of the study, we introduce the term m-learning, which is based on

e-learning and provides a way to improve learning methods opting for mobile learning and teaching, since connectivity allows the creation of networks where members of educational institutions can interact. From this, emphasis is placed on the importance of smartphones, for they are equipped with many tools (hardware and software) that can be exploited in favor of educational objectives. Reliable statistical data will be collected using surveys to learn about the benefits and particularities of various mobile devices such as brand, memory capacity, network costs, users' preferred applications, usage frequency and others, thereby making it possible to observe and model the reality to which we intend to give added value. These data are very useful for any type of research related to modern education, as they allow observing how the bases are being formed to face a new stage in education in a more technological and systematized way (Cataldi et al., 2012).

Data also provide further evidence of whether teachers are in a position to use a smartphone, as not everyone has the same requirements when acquiring a mobile device. Furthermore, teachers' training requirements are aspects that need to be considered, since the use and/or method of teaching among colleagues varies. The results of the surveys confirmed our previous thoughts about the teacher-technology relationship: students have a greater advantage when it comes to technology compared to teachers. A more comprehensive picture of the users' needs is obtained from the results, and solutions are proposed involving learning situations that complement the activities and are of benefit to the parties involved. A new paradigm called "learn, unlearn and relearn" is thus revealed, in which both teachers and students are integrated.

Mobile application for school management

People with smartphones forget that the device they have in their hands is a portable computer that can be used as a multi-featured problem solver. At Universidad Politécnica de Francisco I Madero (UPFIM) in Mexico, researchers detected two problem areas for students, these were: students' attention to schoolwork, from the enrollment process to the homework (grades, schedules and general information), and the response time to the requests they made (Gomez et al., 2016).

At UPFIM, the development of a mobile system is proposed to address both the university's problems and the different types of changing realities; to this end, a development method called the Rational Unified Process (RUP) is proposed. Upon choosing

the method, the system that is intended to solve the problems of the students of the aforementioned university is named C.A.S.A. Attempts to use the same system in other institutions encounter barriers, as each entity has its own processes, which often differ from the standard ones. Customization is very important at this stage, so that small changes (such as colors, logos, images, resources) and much more significant changes (such as process changes, removing or adding modules) can be made to adapt to the reality of each institution. This is known because the system is implemented in a school where such barrier is observed. The system is currently being tested in two educational institutions: the university where the system was developed (UPFIM) and the Tecnológico de Monterrey, Campus Hidalgo. It appears that the system, implemented in a mobile system as it is a widely used tool in that university, efficiently solves specific problems.

The university has informed us of their intention to implement the system in a school on a trial basis.

Analysis of apps for smart mobile devices aimed at supporting academic reinforcement at DES DACI

Poor student performance is a problem that concerns teachers, parents and educational institutions; it is believed that it could be due to poor study habits, family problems, lack of motivation, among other. The excessive use of smartphones is another noteworthy and current factor related to this problem, as students are more focused on their cell phones than on class, and, in the hallways, they are immersed in social networks, games and movies. All these activities distract them, and therefore they do not devote time to academic activities or simply forget about them, affecting their learning. However, what would happen if, instead of being the cause of the problem, the use of smartphones became an asset to improve academic performance? That, coupled with the use of applications, would benefit the educational environment (Herrera & Buenabad, 2013).

At present, smartphones are the most used phones by the student community, given the ever-increasing technological demand. At the Dependencia Académica Ciencias de la Información (DES DACI) of Universidad Autónoma del Carmen (UNACAR), located in Ciudad del Carmen, Campeche, Mexico, there is a significant percentage of students with poor academic performance; for that reason, following a quantitative study, it was determined that the university should opt for technological tools to capture the attention of students. After implementing

Evernote, Dropbox and My Homework technologies in the university, the results were encouraging; thus, the university took a first step towards the systematization of its classrooms and teaching processes and, at the same time, it reinforced the idea of having a mobile platform. Introducing these technologies into the education sector would not only provide uniformity to each institution's processes, but would also enhance the academic development of each student by allowing the retrieval of interesting data useful for completing activities such as homework assignments. It is exciting to imagine what would happen if instead of papers, students would use MS Word on their cell phones or save their files in Dropbox and no longer in a folder.

Teachers and the integration of mobile phones in the classroom

Information and communication technologies in the educational sector must be approached from the perspectives of those involved in each educational activity; to this is added the reaction of teachers, who present the course contents and the annual academic plan and play a fundamental role in the inclusion of these technologies in the classroom. Brazuelo et al. (2017) conducted a study involving teachers of compulsory secondary education in Las Palmas (Canary Islands, Spain) that analyzed the use of smartphones, as well as teachers' attitudes towards the integration of these in academic processes. A certain degree of distrust was observed on the part of teachers towards the use of smartphones in the classroom and the integration of these technologies in academic processes that bring students closer and optimize their work as educators. This situation is more common among older teachers, who are unaware of the benefits that these tools could offer them and the institution. The challenge is to convince them that the tool is functional and is a facilitator of processes to create a better classroom experience.

The age range of the teachers who participated in the study was between 36 and 51 years, and the results were diverse. On the one hand, a group of teachers considered that technology is advancing at a rapid pace; they also stated that the students' experience with devices compared to their lack of training in this area and their age is a factor against them. On the other hand, another group of considerably younger teachers regards smartphones as tools that make communication between parents, students and other members easier, faster and more dynamic. Based on this assessment, we intend to carry out a search for information that serves as a starting point for future research and improvement

proposals, thus taking a step towards the systematization of educational processes and benefiting society using ICTs for school education on all levels.

Is it possible to integrate mobile devices in elementary education as an educational resource?

The integration of technological tools and resources in the classroom is a viable reality that facilitates communication between parents, teachers and students. As for the use of mobile resources, it is worth mentioning that their implementation alone will not lead to a significant development of cognitive skills given the current academic situation, a proper teaching planning, where the interrelation of activities is beneficial for students, is essential (Gértrudix & Barroso, 2016).

A research based on a survey of 68 students in the 5th grade of primary education in a public school located in the province of Toledo, Spain, (Gértrudix & Barroso, 2016) addresses key aspects such as the number of children with access to a mobile device, usage time and type of applications of their preference. Upon observing the results, it was concluded that children aged 10 and 11 years had mobile devices (smartphones and tablets), a surprising fact given their young age; it was also determined that the most used applications were those for games and messaging, likewise, the number of hours they spent on the mobile phone is also striking. Based on these results, an application for learning historical content in the context of a 5th grade classroom was proposed. The data obtained indicate that elementary school students have different needs and have exchanged toys for technology; parents need to remain vigilant against the excessive use of mobile devices. In some cases, students are only allowed to use their phones on weekends. Teachers should motivate young students to use technology in the best way possible, so that they do not find it boring and do not misuse it.

METHODOLOGY

First, materials related to the topic, found in indexed databases of recent years, are collected and reviewed in order to know the current status of the research. Then, the analysis and classification of the scientific material directly related to the use of mobile applications in the education sector is performed. Following these instructions, it was possible to select the articles referred to in this research.

Once the relevant material and studies on mobile applications used in education are available, the analysis and description of the model should be

conducted before starting to develop the application. The purpose of this analysis is to have a plan to follow to try and optimize communication and interaction between the members of the educational institutions via a mobile application.

Based on the model, the application is developed within a reasonable timeframe using the chosen tools; specific roles (teachers, parents, students and administrative staff) as well as specific functions for each role (tasks, notes, messages, attendance, agenda, news, etc.) are established. Upon completion of the development stage, the mobile application is tested in selected institutions to assess its adaptability to different scenarios for the benefit of education.

RESULTS

It can be said that academic activities in secondary and higher education concern students and teachers, while at elementary level, it concerns parents, teachers and students; therefore, interaction is somewhat limited (Fuentes, 2015). There is a need to know the current situation in depth and aim at automation.

The proposed system aims to clearly define the users and include administrative personnel, education assistants and all people who are part of the educational environment.

This mobile application conforms to the requirements based on the data collected from the research, which can be summarized as connectivity, usability, user-friendly interfaces, portability, simplicity and optimal complexity.

This mobile application is a tool to transform classroom lessons and modify the way members of each institution interact with each other, promoting constant communication every minute of the day to optimize academic processes and benefit all people involved.

Some parents have old-fashioned ideas and are wary of their youngest children using mobile devices, perceiving them as a distraction. The challenge is to convince parents that the mobile application is in the middle ground between usability and trust (Pinos et al., 2018).

On the other hand, teachers interact with other members of their educational institutions more actively; they already have a routine marked by their experience. This system would restructure academic processes and, via the mobile application, would

make teachers" work easier; however, based on statistical data, teachers are often reluctant to use ICTs as they are not conversant with them. They need to be trained in the use of mobile devices as they are well aware of the tremendous potential they have if used in the right way.

In addition to all of the above, administrative staff would be able to interact with parents, teachers, students, teacher assistants and mentors through a platform allowing two-way communication; this would encourage the identification of members with the institution to which they belong, as well as trust.

Our proposal is a mobile application that allows to maintain communication and interaction among its users; to send news, events, tasks, attendance records, messages and incidents; to share images of moments lived in the classroom and/or school; and to schedule each deliverable in an orderly manner so that nothing is left to chance. This is an attempt to add value to everything that happens in the classroom with an application that provides a 24-hour connection through notifications.

Conceptualization

This contribution is intended to analyze the functionality of the system, illustrate its architecture, and explain end-user interaction with the mobile application. It is important to understand how data will be shared among the different users, as the interaction will occur via mobile phones and the workload will be concentrated there. This mobile interaction attempts to be at the forefront in a world where smartphones play an excessive role almost every moment of the day; if they were used for educational purposes to improve performance, a significant advance would be achieved in the educational environment and also in the activities that influence and depend on it.

An educational revolution entails more than just changing a system, it also entails changing the school model from its roots. The present educational model barely includes current technologies; there are technologies that aim to systematize school agendas, but they cannot be properly implemented because the people who make up each part of the model lack the necessary knowledge. The proposed system aims to bridge the existing technological gap in the educational field, as well as the gap that teachers or parents themselves have created as a result of the lack of knowledge on technology.

This system is envisioned as a tool to change the current educational model; however, the system

will not be able to accomplish everything by itself, it will be necessary for each entity to be aware of a digital transformation that will bring about this great change.

Target users

Upon determining the purpose of the system, it is necessary to identify the target audience and their interests, for the needs of a teacher are different from those of a student.

Four types of users were identified: students, parents, teachers, and administrative personnel; each of them responds to a different need, so the most critical functions were identified. The functions that each type of user performs towards interaction and communication between people in each educational institution are shown; furthermore, it is indicated how they perform them now and how they will perform them with the implementation of the system in their study center.

Architectural Model

As shown in Figure 1, the model identifies components that are of vital importance for the correct functioning of the application; they support the architecture, which is expected to grow over time, as the data and workflow will become increasingly complex due to the number of users interacting with the system in real time.

Database

The database is important because it contains all the information required for the system to function. The server will be in the cloud so that connections can be made from anywhere, at any time. A good database design will allow the server to remain operational around the clock and, in addition, to be scalable, a very relevant aspect for this system.

The database will be in MySQL format and will have standardized tables to support all the logic to be implemented.

Initially, data will be hosted in the Hostinger server, where the database will be connected and running; from there, all users will be able to connect to it using APIs.

Cloud Messaging Firebase

This part of the architecture (see Figure 2) relies on the technology provided by Firebase. One of the objectives of this system is that parents, students and teachers are always informed of activities,



Figure 1. Architectural Model.

Source: Prepared by the authors.

homework or any issue that occurs in the school, to avoid the typical excuses such as “I didn’t read the note in my notebook” or “I forgot to tell my mom”. In order to manage notifications efficiently, users will rely on Cloud Messaging Firebase.

It provides the following tools for the proper functioning of the system:

- **Registration Token**

A registration token request is sent from the mobile device, which enables the mobile device to be identified from any point. Each mobile device has a registration token that is unique in the world, this allows sending personalized messages or notifications that can be mapped.

- **Topic Subscription**

Another tool is topic-based subscription, which works in a similar way as when a user subscribes to a YouTube channel to receive notifications. For this educational application, this tool is very important as it allows the user to receive notifications of tasks, events, memos, group chats, or any other data that has been entered into the system. This section is fundamental, since it is where the whole concept of notifying each user in real time is supported by simply

sending an unlimited number of notifications on a specified topic from a web service.

For instance, when the teacher enters an assignment with the subject “AssignmentsSchedule5” all students and parents who are enrolled in the schedule with identifier 5 will be notified.

- **FirebaseMessagingService:**

- This service, which will be running in the background on mobile devices, it will respond to each notification and will redirect the user to a specific screen by touching each notification. The proper functioning of this service is crucial.

In short, Firebase will enable full control of notifications and will make the project scalable as these services support a large amount of data.

API REST

It is necessary to develop the APIs for an efficient communication between the mobile devices and the server. These APIs are developed in PHP and java, which makes their maintenance and updates processes easier. The logic of the model interacts directly with the database, retrieving data when requested through JSON, which is then returned to be processed in Android.



Figure 2. Cloud Messaging Firebase.Source.

Source: Prepared by the authors.

These APIs also call the services provided by firebase doing all the logic from here. The connection and the transformation to JSON. Proper use of this part of the architecture ensures proper operation and efficient maintenance.

Internet

As any current system must have internet coverage, the connection is the most important thing to send notifications or post any event. Efforts are made to consume as few megabytes as possible, and to send as few requests to the server as possible using HTTP.

Efficient use of this resource provides an optimal solution for the user.

End-users

It is at this stage of the architecture when the mobile application becomes important, users interact with the mobile application to, in turn, interact with other users associated with each educational institution. Teachers will be in charge of subjects and students who in turn will be connected to parents.

All mobile devices will be connected to each other and it will be easy to collect data within each module. The architecture is designed so that the user can locally access the information stored in the local database, even if he/she has run out of data. In

this case, however, the user will have access only to previously viewed information.

This information will be useful for users because they will be able to access their tasks, notes, events and even messages without internet access, thus making the architecture more robust.

Surveys

In order to implement this system, we gathered information about the target market, i.e., elementary and secondary schools. Surveys were used for this purpose, as they allow obtaining reliable data to ensure a solid basis for our project (Sanchez et al., 2014). The surveys were conducted in Cono Norte in three stages: the first was carried out prior to product launching; the second, days after launching the product; and the third, after the end of the first school term.

- **Prior to product launching**

The purpose of this part of the survey was to assess how students, parents, teachers, principals and all the people involved in the educational institutions would receive a mobile application that is intended to improve the interaction between them.

At pre-school level, it was observed that a student module was not so necessary, given that only 3 students (5 years old)

had smartphones, whereas all the teachers had one. Also, it was observed from the survey that both parents and teachers at this level are at the forefront of technology. At elementary level, it was observed that a small percentage of teachers did not have a smartphone, whereas a large number of students had one. At this level, students had restricted data usage and, those who did not have data, stated that they accessed the Internet at home. At secondary level, it was noted that teachers, who were older, often had basic mobile phones rather than smartphones, whereas almost all students had one; in addition, teachers often did not have access to data, but were willing to acquire a data plan.

It was also observed that the limited knowledge regarding educational platforms constitutes a barrier hindering the transformation to the digital era. It is mainly parents and students who have little or no knowledge on the use of such platforms, while teachers or administrative staff do have experience in this regard due to the use of virtual classrooms during their training or because they have seen some on the Internet. For students who do not have access to a mobile phone, the best form of communication is through Facebook; while, for those who do have one, communication through WhatsApp is better.

The interest that people showed in the possibility of having a system that notifies them of something as simple as homework was quite surprising; this response suggests that they see the system as a potential solution to a need. Users do not want a new e-mail and password, they stated that it would be better to use a system similar to WhatsApp, where users only need to register once and that, when logging into the system, they can log in directly, which makes the process easier.

The results obtained in the first surveys are encouraging. In accordance with what has been stated, we want to provide a system that satisfies the basic needs of parents, students and teachers in order to contribute to academic development; at the same time, it is important to recognize that this is not only an application, but a change in the learning and communications model.

• Days after product launching

According to the results, the system was well received by the users and the people surveyed were duly informed by the schools about the use of the application in favor of the digital transformation. User acceptance rate was above 90%, which shows that the system is on the right track. Likewise, a 92% acceptance rate was observed from teachers, something that was surprising at the time, but that would be useful to identify problems or issues that may not have been evident. Students, parents and administrative personnel were satisfied, since their function fully complies with the parameters that were projected. A 100% approval rate was obtained in terms of usability, and simplicity of the screens.

The system had to be tested to verify if notifications were being delivered in real-time every time there was an interaction; it was very important since we depended on the Firebase service. It was gratifying to know that users were being notified correctly, which proved the usability and functionality of the system.

• At the end of the first school term (August 26, 2018)

This third stage of the survey was directed to the teachers, since, after closing the first period (bi-monthly or quarterly), it was necessary to know if the system had worked as expected and if the users' reaction had been satisfactory. To this end, a 5-question survey was prepared for 50 teachers from the different schools we approached. Results showed that all teachers agreed that the homework module had been very useful. They even felt that the system made their job easier, since they were able to send homework to all their students and parents in a matter of seconds. Therefore, sending time was reduced and communication was maintained.

It was also noted that the grading module was very useful for teachers because it fulfilled the function of communicating. It is not a super module for calculating averages, but a record of grades; the teachers were able to understand it and it was useful, however, the system still needs to be optimized and transformed into a virtual classroom.

Teachers were happy with the system, and while it has potential, there are still areas for improvement. This is the first version of the system and it complies with its function, makes the users happy and, therefore, the first stone for the digital transformation has been laid.

The surveys were conducted in three different stages, thus providing a great insight into what the system is capable of delivering in the educational institutions. The digital transformation can be observed using these data.

Application Development

Interfaces

In order to better visualize the proposed system, the interfaces designed for the school interaction and communication system, which we have called MottyApp, are presented.

Figures 3 and 4 show the screen that the user will see after downloading the application from Play Store. The user code that will be provided when purchasing the system is entered on this screen. Once

the code is entered, the system will associate the user with the code and will display Figure 5.

Figures 6 and 7 represent the main screens according to the user assigned. Each user has its own modules, some of which differ in terms of functionality, while others are similar. The sidebar was designed for the user's convenience, since it is much easier to have all the options on the main screen, thus avoiding unnecessary system flow.

Figure 8 represents the news display screen, which will slide upwards, resembling Facebook, to make the user feel comfortable and more familiar with the application.

Figure 9 shows the album module that will display the albums created by users in an organized manner with the tag "new", so that the network is updated on the number of photos and albums. Each album will be associated to a subject or section, to which only authorized persons will have access; there is no limit to the number of photos that can be added to the albums.

Figure 10 represents the schedule screen, one of the most important screens of the system, for it will

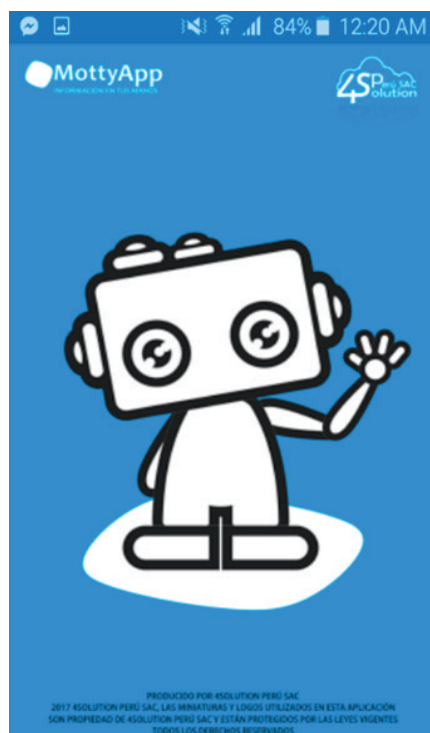


Figure 3. Startup splash screen.
Source: Prepared by the authors.



Figure 4. Registration screen.
Source: Prepared by the authors.



Figure 5. Registration confirmation screen.
Source: Prepared by the authors.

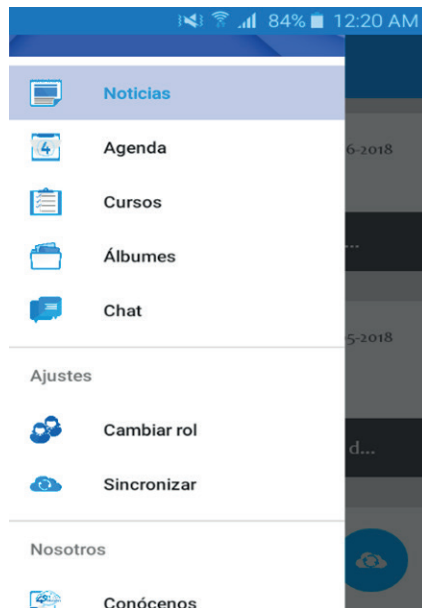


Figure 6. Main screen (student).
Source: Prepared by the authors.

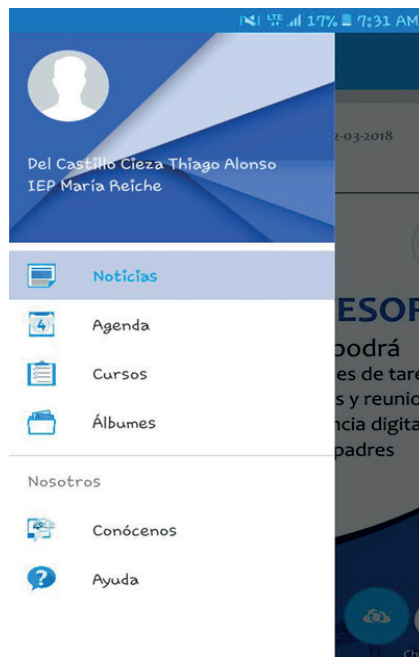


Figure 7. Main screen (teacher).
Source: Prepared by the authors.



Figure 8. News display screen.
Source: Prepared by the authors.



Figure 9. Album screen.
Source: Prepared by the authors.

collect all the information to be displayed in a calendar using different colors with their own meanings to indicate whether it is a task, an event, a meeting, etc.

To see what is scheduled for each day, you only need a touch to see the pending tasks for that day organized on a single screen.

Figure 11 represents the subject screen that will list the courses in alphabetical order and associated with an image to make browsing easier for the user.

The images displayed are dynamic and change according to the season of the year. These courses are the ones that the student takes; if you are a parent, they are those taken by ones your child =; and, if you are a teacher, they are the courses that you teach. Images are used to organize and systematize the information.

Figures 12 and 13 represent the menus within each course and have well defined functionalities. It is a very interactive menu and full of colors to attract people's attention; each course will have its own menu of tasks, incidences, events, attendances, etc., to maintain order. This menu slides upwards so that the user finds it familiar, and the transition to this tool is easy.

Figures 14, 15, 16 present some of the screens that will be seen within the course menu, all following the same design to maintain uniformity, which represents exactly our proposal: an organized, useful and user-friendly system.

Figures 17 and 18 represent the parents and teachers' module, as well as the chat, which will contribute to the solution of the communication and interaction problem by bridging the existing gap; its design is user-friendly and dynamic. Figure 19 represents the parents' GPS module, aimed at bringing them closer to the students, since parents will know the exact location of their child in real time just by entering the module, allowing them to monitor their children.

DISCUSSION

Upon initiating this project, we noticed that some schools used messaging applications to perform their activities and maintain communication with the participants of the classrooms.

Using the applications available in the market to perform school activities makes browsing and receiving pending messages tedious, order cannot be maintained and not all people are familiar with these apps. Therefore, this study seeks to maintain



Figure 10. Schedule screen.
Source: Prepared by the authors.



Figure 11. Subject screen.
Source: Prepared by the authors.



Figure 12. Courses menu (teacher).

Source: Prepared by the authors.



Figure 13. Course menu (parent and student)

Source: Prepared by the authors.

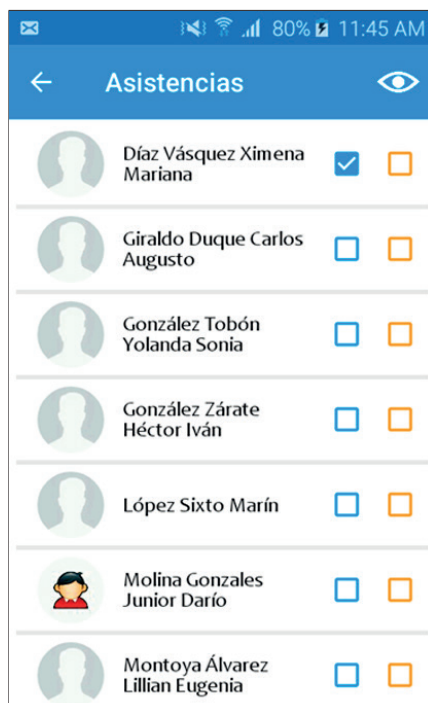


Figure 14. Attendance.

Source: Prepared by the authors.

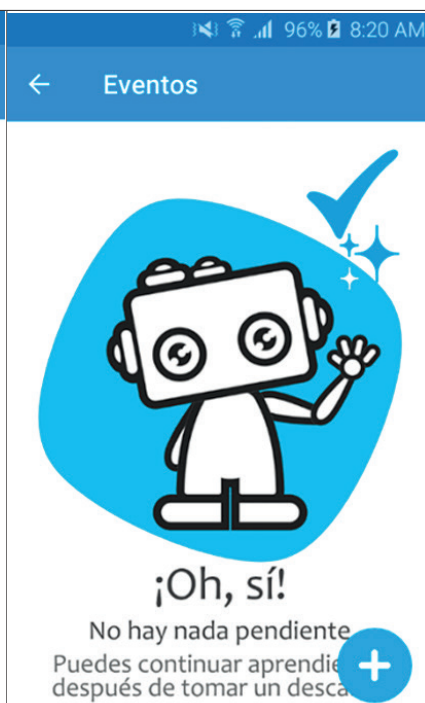


Figure 15. Events.

Source: Prepared by the authors.

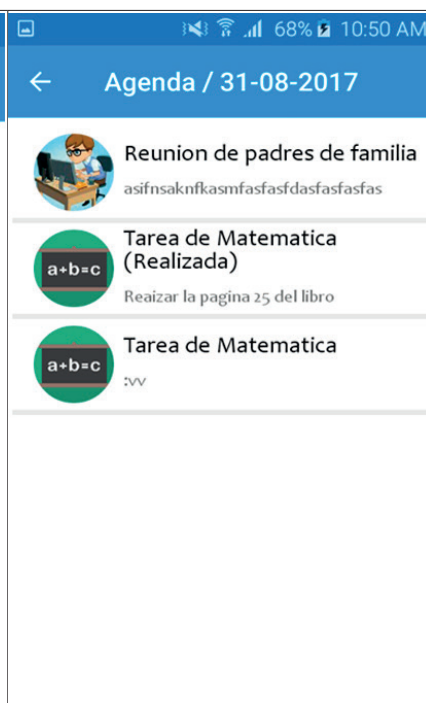


Figure 16. List of pending tasks.

Source: Prepared by the authors.

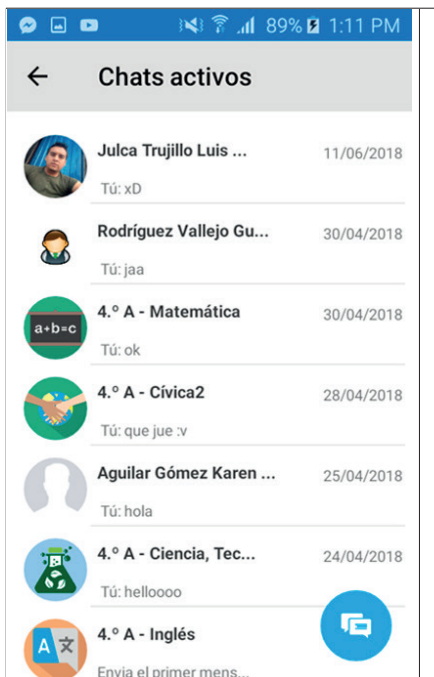


Figure 17. Chat list.

Source: Prepared by the authors.

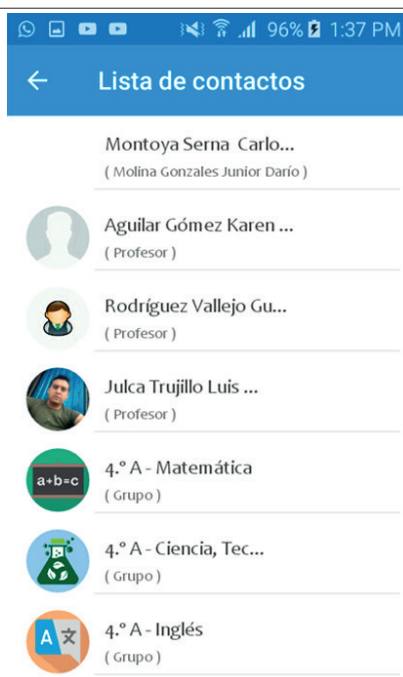


Figure 18. Contact list.

Source: Prepared by the authors.

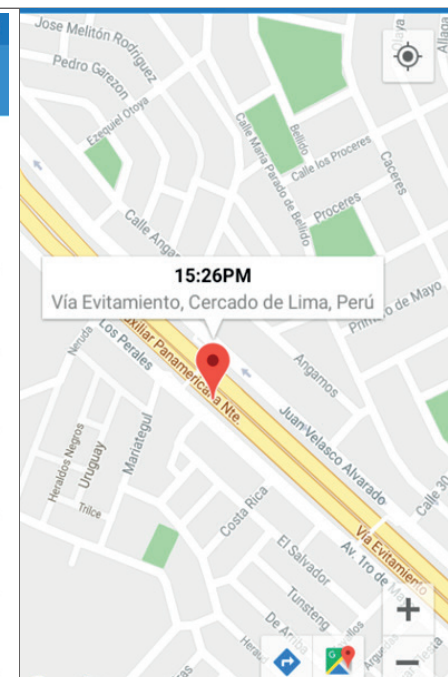


Figure 19. Student's location.

Source: Prepared by the authors.

an order for each activity, whether it is a to-do list, notes, homework, memos, messages, etc., via an intuitive, effective, and easy-to-use application that can be used by people of any age. In this sense, this application attempts to take a step forward in the use of technology in schools in order to contribute to the academic growth of students, as well as to the comfort of teachers and parents.

CONCLUSIONS

It is clear from the study conducted that there is a gap between the educational sector and communication. In a world of technology like ours, it is important to take advantage of the technology that we have at hand every day, i.e., smartphones.

Communication and interaction between the people involved in an educational institution is deficient; however, the system we propose is a big step towards improvement and responds to a need that, in general, does not receive the necessary attention. Thanks to the information provided before the implementation of the mobile application and to the people surveyed and informed about the benefits of this system, together with the fact that they have functionally interacted with it, it can be said that the system provides solutions to the long-standing issue of communication between parent-student-teacher.

This mobile application has its limitations, but it is the starting point towards digital transformation. The modules were developed bearing in mind the needs of the people involved. It provides a simple way to address those needs and allows for the possibility of improving the modules, as well as recognizing new functionalities that may arise in the future. The system complies with the stipulated in the problem statement and the study was formally conducted.

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