# Participatory Design for Mobile Application for Academic Management in a Brazilian University

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**Abstract.** The object of this work is to report on the research process for the development of a mobile software application devised for academic management - SIGAA - at Rio Grande do Norte Federal University (UFRN), in Brazil. Using the methodology of Participatory Design (PD), Prototyping, and other participatory techniques, the application's interfaces were developed, and three types of prototypes for the registering and editing of student presence were tested. The implications inherent to each model, and usability recommendations for the formulation of usability guidelines for the academic information management applications project were also ascertained.

**Keywords:** Design, Participatory Design, Mobile.

## 1 Introduction

Students have increasingly been exchanging messages and searching for information by means of mobile phones and smartphones instead of using only microcomputers for these purposes. Faced with this trend, the Informatics Superintendency (SINFO) at Rio Grande do Norte Federal University (UFRN) chose to develop a mobile version of its Academic Activities Integrated Management System (SIGAA) and started a partnership with the Interface Ergodesign and Usability Experimentation Laboratory (LEXUS/UFRN) for the interface redesign, since after the development of several initial prototypes, several usability problems were found in unsystematic surveys.

SIGAA, an application originally devised for desktops, enables communication between professors and students by means of divulging student presence, evaluation grades, class plans, news, projects, message exchange, school library book collection consulting, student enrollment, among other functionalities related to academic activities.

It is important to state that the proposition for the mobile version of the application is not to replace or reproduce all functionalities found in the desktop application already deployed and consolidated at that University, but to adapt to the needs presented by new use contexts. To this end, the Participatory Design [1], [2], [3]

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approach was employed to: a) further the understanding about the user profiles (students and professors at the institution) and their needs and specificities; b) propose functionalities that are more appropriate to their ends and use contexts; c) propose more natural and effective interaction models and interface styles.

## 2 Methodology

In this research, the methodology adopted was the Participatory Design approach, where users are actively involved in all stages of the project, in the definition of the resources to be made available, and in the visual solutions to be implemented.

The research was carried out in two phases. 'Phase I - Survey and Problematization' was aimed at inquiring on values, beliefs, opinions, use patterns and use contexts of the users interacting with SIGAA, both in the desktop version and in the mobile version currently in initial development process by SINFO. In 'Phase II - Project and Prototyping', taking into consideration investigative aspects in 'Phase I', prototypes were developed with three different interfaces and interaction models for the functionality used by professors to include and maintain information regarding students' presence — which had been detected as one of the most troublesome during interaction.

### 2.1 Phase I - Survey and Problematization

In this phase of the research, studies based on ethnography were carried out involving professors (n=7) and students (n=10) from the institution. Below are the techniques employed in 'Phase I - Survey and Problematization' of this research:

Focus group [4], [5]: meeting of a representative group of the system's users, with different profiles, to enumerate needs and expectations towards the product — seven students took part, distributed in two sessions.

Contextual analysis [4]: in their work environment, the interviewees expose their difficulties and expectations when interacting with the application. Analysis was carried out with five professors who demonstrated their usage relations with the desktop version.

Cooperative evaluation [6], [5]: participants are solicited to interact with the system while conducting tasks defined by the research team. They are encouraged to verbalize their thoughts and opinions regarding usage of the system and elements of the graphical interface, exposing their impressions and expectations. Two professors and three students took part.

Regarding quantitative techniques to analyze reports and interaction logs, information from 26,219 students [7] and 1,896 professors at UFRN was considered [8]. It should be noted that the logs and reports analysis was useful to identify navigation patterns, behaviors and system functionalities more often used by the participants.

### 2.2 Phase II - Project and Prototyping

In 'Phase II - Project and Prototyping' of this research, prototypes were elaborated for the evaluation of three interaction models of the process wherein professors include and maintain information regarding student presence. Subsequently, a Usability Test was filled out. Below are defined the techniques employed in 'Phase II' of this research:

Prototyping [9], [10], [5]: the limited representation of a design, allowing users to interact with it and explore its conveniences. A communicational environment among members of the team, and an efficient way to test possibilities responding to matters that can effectively help the designers to choose one among several alternatives.

Usability Test [10], [4]: a source of information on how people use computers and which interaction problems they find when interacting with the interfaces being tested.

It is important to mention that, owing to the complexity of the interaction models involved in the resource being investigated, it was decided to use High Fidelity Prototyping, as it allows for greater interaction resemblance with the finished product. Santa Rosa & Moraes [5] further point out that paper prototyping brings along the difficulty of simulating the behavior of some interface elements, such as scrollbars, information conveyance through colors, execution of animations, and the fact that this type of methodology does not allow the detection of all types of usability problems.

Description of the proposed interaction models:

**Model I.** In 'Model I', interaction for launching and editing student presence is accomplished via a contextual menu that is presented at the moment when the user selects one of the students in the listing. Once selected, the option is positioned on the screen near the student's name (Fig. 1).

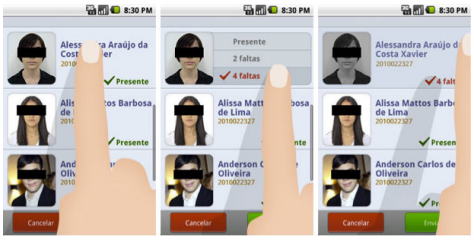


**Fig. 1.** Illustration for Model I interaction

**Model II.** Interaction in 'Model II' is closer to the version originally implemented by the programming team at SIGAA mobile, with the change of the presence status indicator happening by consecutive tapping gestures over the cell that contains the student's name onscreen. However, it should be noted that, should a user inadvertently select an unwanted option, they will need to cycle through all other options again until being able to select the desired status (Fig. 2).

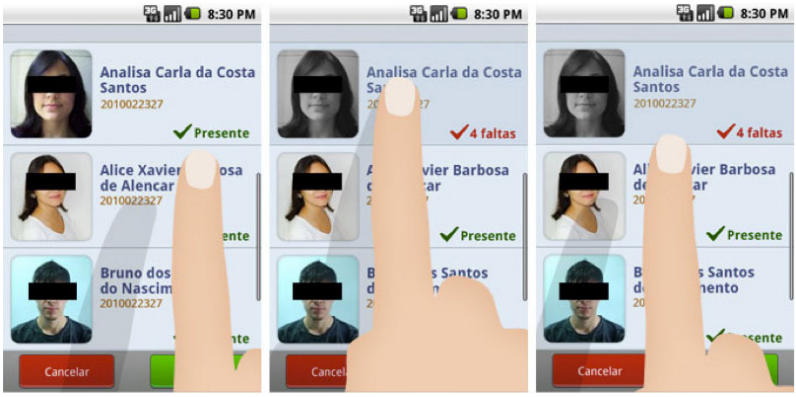


**Fig. 2.** Illustration for Model II interaction

**Model III.** 'Model III' eschews the contextual menu or consecutive tapping gestures. Student presence is entered via a horizontal slide gesture over the cell that contains each student's name. Placed near the student's name, the student presence indicator cycles between the options (Fig. 3).

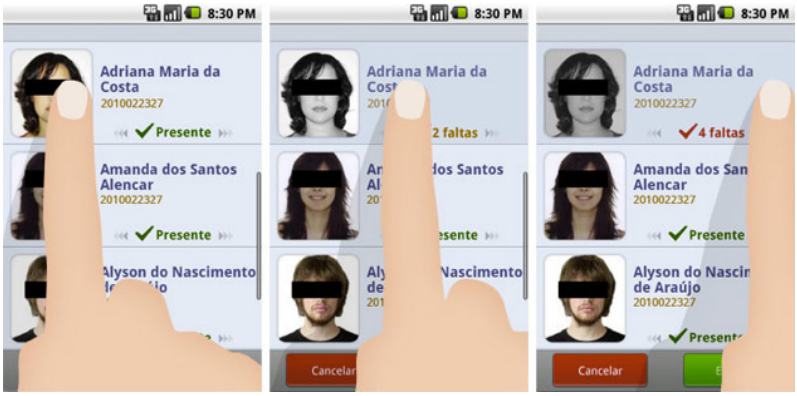


**Fig. 3.** Illustration for Model III interaction

Participants in the Usability Tests were professors from the Science and Technology area (n=3) and Design area (n=2).

Below are presented the main results obtained from the research, using the aforementioned methods.

## 3 Results

### 3.1 Results from Phase I (Survey and Problematization)

**Focus Group.** Two homogeneous group focus sessions were conducted, with three participants in the first one and four participants in the second. The first group was

formed by students from the Arts field who did not own smartphones. The members of the second group, students at the Design course, were well acquainted with such devices.

To guide the focus group effectuation, questions were developed, aimed at gathering information regarding the usage of the SIGAA desktop application in students' everyday life, which system functionalities are considered more important, the locations from which the system is more often accessed, possible usage difficulties, behavior patterns for reading and communication, estimates of access session durations, participants' inclination towards using the Academic System's mobile version, and resources considered by participants as essential in the mobile application.

When asked about how their daily procedures would be without SIGAA, most participants remarked that it would be a retrogression, since the Academic System enables students to procure enrollment certificates and documents, renew book loans at the University library, and register enrollment. "I would not have as much free time as I currently do", one interviewee mentioned, referring to the time gained due to the ease to obtain class material, circumventing the old need to get in line to use a copying machine.

Altogether, it was found that the students were keen at the possibility of checking grades, course contents, student presence and news using only their mobile phones. I was also ascertained that some students who do not utilize computers and mobile phones were resistant to use the Academic System in computers and mobile phones. One of them pointed out that "the computer came to solve problems we did not have" and "the Academic System could make him a hostage to information". The student also made clear his preference for mediation done by a human being, instead of computational systems. Nevertheless, this very student stated, later during the same session, that he had had the need to enroll in course subjects during a trip and that, to this end, he had made use of a laptop computer connected to the internet.

Among the main functionalities used by interviewees are: grade checking, student presence checking, class plans perusal, and the possibility to download and read texts. However, a few students identified the necessity for error messages to be made more elucidatory, and for the presence of contextual instructions regarding some academic norms and procedures.

Some members from the second group recounted the experience of reading information in the mobile phone screen: "it's a tedious process because we keep needing to use zoom in and zoom out", in reference to readability problems. Everyone was in favor of the mobile application development, as it would become one more access medium to the aforementioned main functionalities, in addition to the new functionalities that mobile technology has to offer, such as: GPS system to locate designated sectors inside the campus, quick access to the library book locator, and the possibility of viewing urgent notices, for example last-minute changes in class times and locations, and in grades, among others.

Students also pointed out that both the desktop and mobile systems enable greater agility, time saving, and more autonomy in the ambit of the University. According to some of them, being able to monitor the course program and the class content,

viewing messages sent by professors, and accessing files containing class material and notes submitted by professors, helps students to better comprehend each class program's role in the course. As stated by one of these students, from the frequency with which a professor submits educational material, it is possible to glean an idea on how much this professor is committed to the course program.

**Contextual Analysis.** The method was used to analyze the ways in which professors make use of the desktop SIGAA system. Contextual analysis is based upon four concepts: context, partnership, interpretation and focus. In cooperation with the user, the developer analyses the software tool in their own working environment, thus focusing on interpreting and solving problems pertaining to their own context [4], [3].

It was possible, by way of interviewing the five professors in their work environments, to achieve an understanding of the desktop system's usage in its actual context, thus enabling a more precise consideration on the resources needed and on what would be the most adequate interaction model for the mobile version. Although a prior procedure list had been prepared, a partnership relation with the interviewees was sought, encouraging them to recall difficult situations when using the system, always in the scope of the main tasks performed by them. One example were the frequent mentions of SIGAA's news system, which holds special value for most of the interviewees owing to its functioning as a formal register for events in case a student claims any particular activity has not been published, "a safeguard against unfounded accusations", one professor stated. Another professor participating in the research highlighted the need for the system to enable the sending of messages to specific groups of students, and not only to one student or to all students in a class. According to the participant, this would be especially useful in periods when students are turning in essays, when the professor needs to send or request specific information to and from a particular group of students.

All participants agree that the system furthers effective interaction between student and professor. Besides registering grades and student presence, professors regularly publish class material, news, tasks and polls. There were complaints about the system being at times bureaucratic, demanding that unnecessary fields in reports be filled out, and about a few individual usability problems — "tab usage and the 'back' button are not allowed". Everyone pointed out occasional occurrences of system downtime and instability causing the loss of inputted data in critical situations, for instance when filling out grades or student presence. The security factor was mentioned by one interviewee who showed concern regarding data privacy when the system is used on mobile equipment. Faced with this fact, the development team is implementing an approach using offline data input, which is later submitted when the device next connects to the network.

Due to being a complex system, it was found that the SIGAA desktop application is not yet utilized to its full potential — "I don't really ‘get around’ it that well", stated a professor, even though he has been trained on using the system. It is important to note that there is a resource for registering technical support issues built into the system, where the user can report errors, present questions or suggest modifications. In prior unsystematic surveys made with the professors, it was found that all those

who had used this resource were contacted by the development team. According to some professors, this lends credibility to the system, evidencing it as an endeavor that is up to date and in constant expansion and refinement.

System usage via mobile phone application was approved by the majority of professors, even though some of them are not smartphone or tablet users. They were however favorable to using the mobile option when one wishes to check for brief information, send particular alerts to students or input student presence and grades.

Cooperative Evaluation. During Cooperative Evaluation, the user receives specific tasks and navigates through the system while in the presence of the researcher. The technique utilizes the 'think-aloud' protocol, where the researcher asks the user questions seeking to know what the user thinks, for example, when faced with a usability problem. This is an opportunity to obtain tangible answers and perform changes to the project [6]. By using Cooperative Evaluation, the development team can be immediately aware if people are understanding the interface as it is expected to be [5].

For the evaluation, a simulator of the Android operational system was used, running in computers and in smartphones. Also used was the Camtasia Studio software application, which makes it possible to simultaneously capture the screen's video and the user's image during interaction.

The majority of students had no problems carrying out most of the requested tasks, while pinpointing problems related to issues already detected in previous analyses — such as readability problems and issues with information recognition onscreen due to the fact that the current system does not have an adequate typographical deployment.

The absence of labels to identify the names and codes of course programs also contributed to usability flaws. When asked which course program he was currently accessing, an interviewee alleged not to recall.

Some interviewees saw the impossibility of sending messages directly to colleagues and professors as a usability flaw. Comparatively, professors encountered more difficulties when using the system — owing to the need to use a larger number of resources. Opinion diverged regarding the grade input process. One interviewee favored the opening of a panel every time one to four student absences were to be input. Others are comfortable with the system's standard procedure, which works by pressing the same button until four student absences are reached.

All interviewees had a hard time understanding the "delete" button's function — "delete the student here? I will not use it, it feels like I will delete the student from the list". Proximity of this button to the "cancel" option also caused ambiguous understanding — it was not clear to them if the button would undo the current operation or navigate back to the main screen.

Based upon the surveys and evaluations carried out, the screens for the new mobile version of SIGAA were prepared (Fig. 4). The observations raised also motivated 'Phase II' of this research, where prototypes were formulated for a more in depth investigation regarding the student presence registering resource in the mobile SIGAA system.

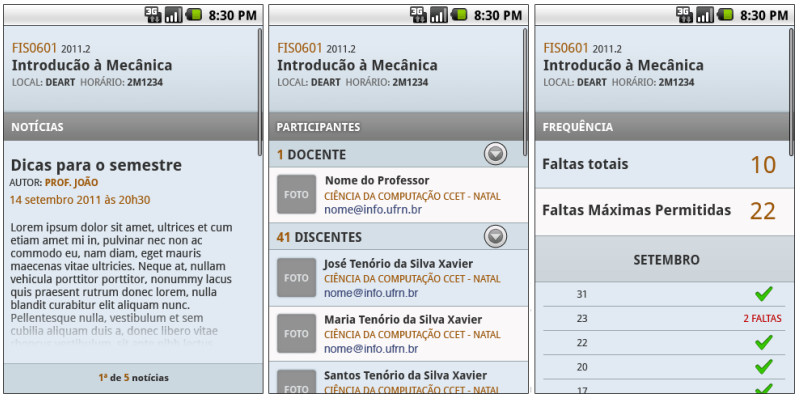


**Fig. 4.** Screens for News, Participants and Student Presence

### 3.2 Results from Phase II (Project and Prototyping)

In this research phase, the participants were professors from the Science and Technology course and from the Design course. The choice for these professor profiles allowed the research of different scenarios — while classes in the Science and Technology course usually count 150 students, in the Design course there are about 40 people.

**Results from the Usability Test with the Prototypes.** 'Model I' was considered the easiest to use. One participant stated that the contextual menu's presence conveyed a sensation of control. Another underscored the slow interaction with the model: "In a real life scenario, where professors from Science and Technology have very numerous classes, it would be impracticable to deploy this option". 'Model II' was considered the best alternative due to its agility and the possibility of selecting any point within a cell. And 'Model III', as one participant remarked, was initially seen as "counterintuitive": "what's the secret with this?". However, once acquainted to it, all participants considered the interaction model in this proposition as the most adequate to the context of numerous classes, due to the ease of entering consecutive registers of student presence — as users interact in a more natural way, moving a finger towards the person's photograph when attributing a presence mark to a particular student, and in the opposite direction when registering absences.

## 4 Recommendations (Usability Guidelines)

According to the surveys and evaluations carried out in the two phases of this research (Survey and Problematization | Project and Prototyping), procedures were devised in the form of usability guidelines that can advise the institution's designers and developers during the development of the application and of other modules that may be designed in the future.

D.1 Utilize minimalist design for the interface;

D.2 Always take into consideration using language that is natural to the user when presenting information, especially regarding dates and information about class times;

D.3 Always identify where the user is in the application in a clear manner, showing the selected option's title in an easily viewable area;

D.4 Consider a grid with enough spacing to create whitespace areas and content separators, making item selection easier and improving interaction;

D.5 Apply reduced chromatic variation;

D.6 Standardize the use of colors in order to highlight information that is urgent or very relevant to the user;

D.7 Present the most often used options above the screen "fold";

D.8 Avoid unnecessary elements in the design, such as headers and footers with decorative images or information irrelevant to interaction;

D.9 Opt for tap interaction. Where a screen slide is needed for interaction, it is necessary to signal this option in a clear and readable manner;

D.10 Typography should be compatible with platform specifications.

## 5 Conclusion

Although techniques such as usability testing and heuristic evaluation are known to be useful for interface assessments, the participatory approach, where users (students and professors) actively participated, proved helpful to gather more consistent information concerning usage contexts and users' characteristics and purposes. This enabled the design team to better comprehend not only the resources that should be included or left out of the application, but also the manners in which information is accessed and displayed in the interface. Therefore, taking the proposed system's users into consideration contributes both to the formulation of system and usability requirements and to the proposition of new functionalities and interaction models.

It is also noteworthy that, based on this research, guidelines were formulated which will assist developers in the deployment of new application modules, and, above all, inculcate the programming team with the importance, since initial project stages, of considering "user centered design" as a way to minimize usability problems and flaws and maximize chances of acceptance by the system.

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