

## Handhelds and mobile phones to manage students and resources in classroom: ¿A new handicap to the teacher?

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In this work, we show the common ways of organizing a development project both fail to deliver sufficient usability. Software engineering (SE) practices and research have led to several methodologies that are highly adequate for developing software with little or no user interaction. However, for interactive systems involving significant user interactions, these methodologies have major shortcomings. In our tool, the Human-Computer Interaction techniques and tools are transparently and cost-effectively integrated into SE methods and processes.

**Keywords** usability, user interfaces, mobile devices, education

### 1. Introduction

Nowadays, with the evolution of devices as handhelds or mobile phones and network infrastructure as Wi-Fi or Bluetooth, a new generation of software applications are being developed. It software applications cover a wide range of domains, as for example business, industry, logistic and education. Thus, with this evolution, a scenario where a teacher can manage the student faults or marks using a handheld or mobile phone is not a far-off scenario anymore. Now, there are several software applications with this functionality.

However, handhelds or a mobile phone has several disadvantages that have not a personal computer or a laptop. Some of them are, for example small screen or touch screen. These disadvantages are not a problem to computers science students or teenagers. But, they can be especially important to teachers in a high school. Teachers in a high school are a multidisciplinary community where each member is expert in a particular topic. Every teacher in a high school has not the same formation: some of them are expert in topics related with chemical and others related with computers. In addition, they have diverse range of age. So, including a handheld or mobile phone as mandatory material for the teacher in a classroom can be a problem, because they find it hard to get used and it becomes frustrating to the teacher.

A rich domain that requires special attention is the educational environment. In this subject, there has been an important growth in the last years. For instance, in Spain, regions as Castilla-La Mancha has invested in the implantation of Wi-Fi in high school builders. This kind of bet gives a boost to develop new software applications, which have not been viable up to now. One of these software applications is related with management of students and resources. Using handheld in a Wi-Fi environment, the range of possibilities to manage a high school is significantly increased.

For this reason, topics as usability and adaptativity must be used in this kind of software applications for teachers. The usability is a handicap that forces to develop software focused on the user interface making it usable and adapted to a large range of different users (teachers).

In this work, we show the common ways of organizing a development project both fail to deliver sufficient usability. Software engineering (SE) practices and research have led to several methodologies that are highly adequate for developing software with little or no user interaction. However, for interactive systems involving significant user interactions, these methodologies have major shortcomings. In our tool, the Human-Computer Interaction techniques and tools are transparently and cost-effectively integrated into SE methods and processes. Our proposal is a use-case driven approach, and designers must understand who the users will be. This understanding is arrived at in part by directly studying their behavioural, and characteristics, and in part by studying the nature of the work expected to be accom-

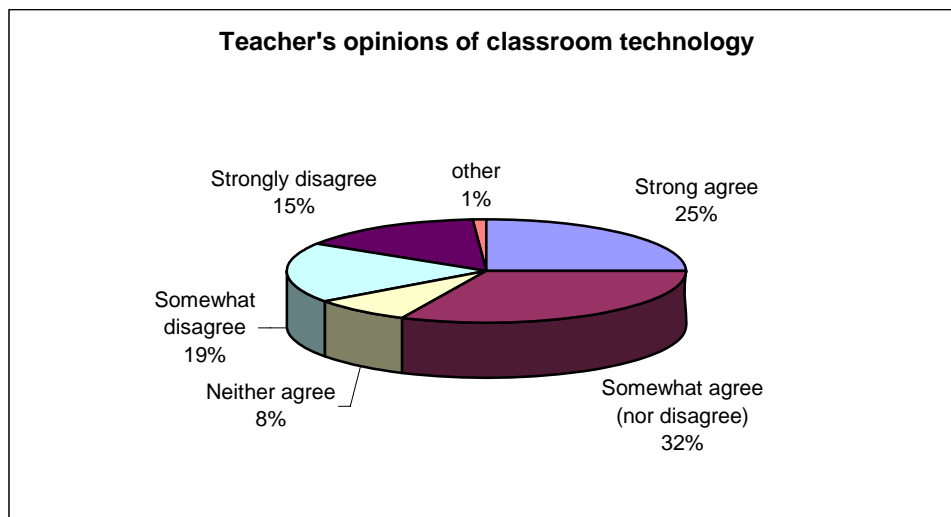
plished. We identify the set of tasks which are enabled over the same time and we use a direct correspondence between tasks and the presentations. These presentations can be used in prototyping and usability testing environments. Finally, the designer can semi-automatically generate the final UI.

By using our approach we develop a software prototype for managing information associated to students in secondary school. It includes functionality as faults control, marks ,etc, i.e. all information that a teacher has to carry out day-to-day in secondary school. In addition, the prototype allows functionality related with resources control, i.e. it allow teacher to reserve resources for a time available in high school, e.g. computers classroom, slide projector, overhead projector, etc. In order to do it, our prototype has been developed over a handhelds connected to a server by Wi-Fi network. The users connect to the server, execute over the handheld the necessary operations and then the new data are stored in the server. Because it uses a web services architecture, it is not dependent of a particular handheld. Even, it can be exported to other devices as mobile phones.

## 2. Usability and Usability life-cycle

According to ISO Standard 9241-Part 11, usability is “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use” [3]. According to Constantine, usability is a key factor in software quality [2]. Furthermore, Larman states that there is probably no other technique with greater disproportion between its importance for the success of software development and the lack of attention and a formal education, as usability engineering and the design of the user interface [4]. Nevertheless, a change can be seen in the attention paid to usability and the HCI (Human-Computer Interaction) practices that ensure the usability of the software product. An increasing number of software development companies are beginning to integrate HCI practices into their SE (Software Engineering) processes. Some proposals for integration ([5], [6]) present ad-hoc solutions which have been created for particular software development organizations, but they lack a generic approach to be applied to organizations with different characteristics.

Usability is the degree to which something - software, hardware or anything else - is easy to use and a good fit for the people who use it. Usability is not just about research and labs. It has a real impact on real projects in the real world. In a 1990 paper, Claire Karat [1] did a cost-benefit analysis that suggested that an investment in usability engineering can product a return on investment in the range of 3:1 to 100:1.



**Fig. 1** Percentage of teachers who agreed that computers and other technology for their classrooms were sufficiently available: 2000–01

Mobile devices such as mobile phones, Personal Digital Assistants (PDA) enable users to access information and web based services from any location with relative ease. This means that users can access the internet using a desktop PC at home or at the office and use the same information on their PDA or mobile phone while commuting from/to home.

Nowadays, a total of 75 percent of the teachers surveyed [2] feel strongly that their work conditions mostly encourage technology use. While 68 percent of teachers reported that their primary location for doing school-related computer work is their classroom computer, 25 percent said they spend 50 percent or more of their home computer time on school-related work, averaging 15 hours a week.

Teachers reported on the availability of technology in their classrooms. In 2000–01, a majority of teachers (57 percent) agreed with the statement "Computers and other technology for my classroom(s) were sufficiently available." Of all teachers, 25 percent "strongly" agreed that this was the case. However, 35 percent of all teachers disagreed with the statement, including 15 percent who "strongly" disagreed (see Fig. 1). These data remark two key elements in software development process: usability and experience. In this sense, we propose an approach where these elements are considered. It will be introduced in the next section. Later, a study case, useful for secondary school teachers, is presented too.

### 3. Our software development approach

The best way to guarantee that a mobile application provides the best user experience is to take the user into account in the design phase. Additionally, it is not enough to consider usability when developing the user interface – usability needs to be a factor in content development as well.

There are many published methodologies for usability or user-centered design (UCD) [7, 8, 9, 10]. All of these methodologies focus on the people who will use a product and the purpose for which they use it, but they also vary in emphasis and approach. In our proposal, quality and experience are integrated in a seamless approach. Quality is usability and experience is gathered by using interaction patterns for UI design.

Interaction patterns are focused on solutions to problems end-users have when interacting with systems. These patterns take an end-user perspective which leads to a format where usability is the essential design quality. The patterns' format is a discussed subject, and we think that interaction patterns have a description textual and can offer a model-based view. Later, in the software development lifecycle, these models can be used again and again, that is interaction patterns are recurring solutions to software design problems you find again and again in real-world application development. Our approach describes a new view of the software life cycle in which quality and experience are actually active elements from the beginning until the final stages (see Fig. 2) [11].

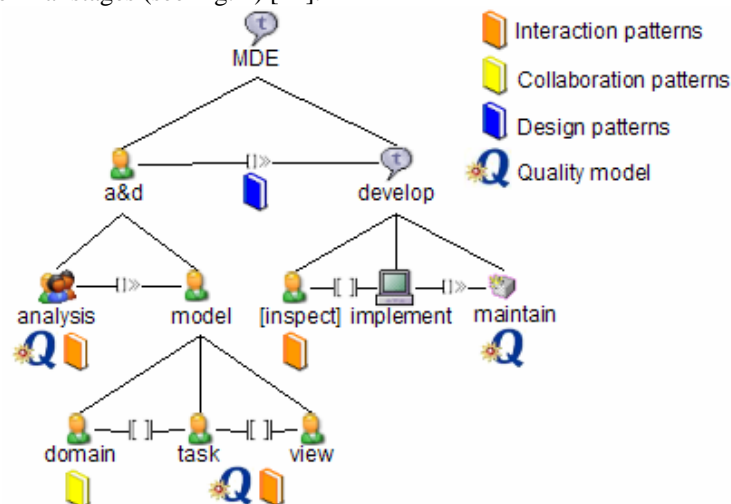
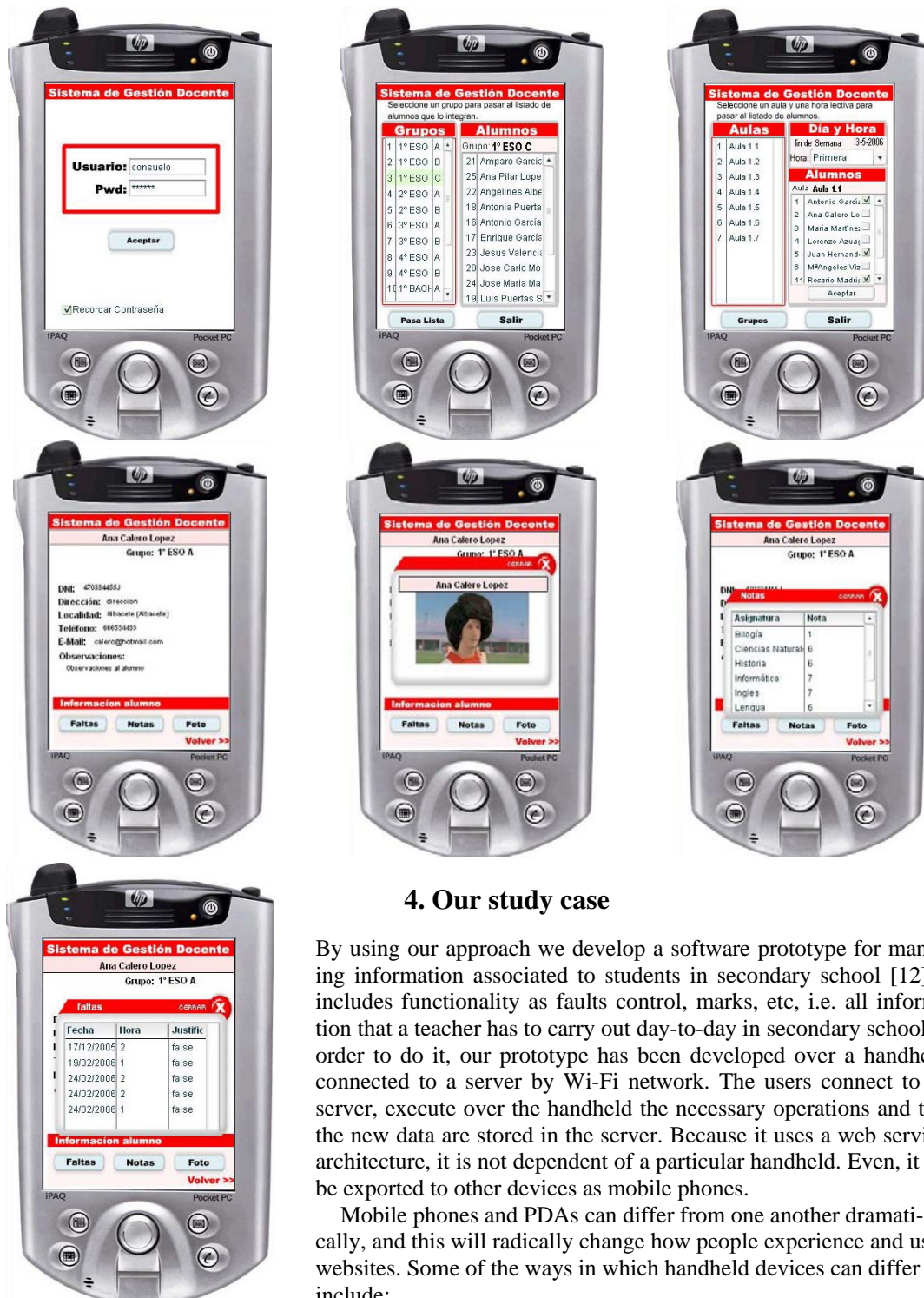


Fig. 2 Our software development approach where patterns and quality are considered

**Table 1** Several screenshots of our study case



#### 4. Our study case

By using our approach we develop a software prototype for managing information associated to students in secondary school [12]. It includes functionality as faults control, marks, etc. i.e. all information that a teacher has to carry out day-to-day in secondary school. In order to do it, our prototype has been developed over a handhelds connected to a server by Wi-Fi network. The users connect to the server, execute over the handheld the necessary operations and then the new data are stored in the server. Because it uses a web services architecture, it is not dependent of a particular handheld. Even, it can be exported to other devices as mobile phones.

Mobile phones and PDAs can differ from one another dramatically, and this will radically change how people experience and use websites. Some of the ways in which handheld devices can differ include:

- Screen size (small vs. large)
- Screen layout (portrait vs. landscape)
- Input device (stylus, numeric keypad, dial-wheel, QWERTY keypad)

Because the mobile phone / PDA that someone is using will have such a profound effect on their experience of your site, you should try to test with as many mobile phones and PDAs as possible.

## 5. Conclusions and future works

We have described a framework for the integration of HCI activities and techniques into the software development process. Our proposal is aimed to software development organizations wanting to introduce HCI aspects into their development practices.

HCI techniques and activities have been organized according to a scheme that may be mapped to the activities being carried out in any software development organization. This process is eased by the employment of SE concepts and terminology to characterize HCI aspects, so they can be assimilated by average software developers. Once this starting point is reached, the actual introduction of specific HCI techniques may be considered.

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## References

- [1] Karat, C. Cost-benefit analysis of usability engineering techniques. Proceedings of the Human Factors Society 34th Annual Meeting. Santa Monica, CA: Human Factors Society (1990).
- [2] Felix, K. How teachers use technology. NetDay, 949/609-4660, <http://www.netday.org> and BellSouth Foundation, <http://www.bellsouthfoundation.org/>. (2004)
- [3] ISO, "ISO 9241-11. Ergonomic Requirements for Office Work with Visual Display Terminals", ISO, 1999.
- [4] Larman, C. "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and the Unified Process", 2nd Edition, Prentice Hall PTR, 2002.
- [5] Anderson, J., Fleek, F., Garrity, K., and Drake, F. "Integrating Usability Techniques into Software Development", IEEE Software, vol. 18, no. 1, pp. 46-53, January/February 2001
- [6] Radle, K. and Young, S. "Partnering Usability with Development: How Three Organizations Succeeded", IEEE Software, vol. 18, no. 1, pp. 38-45, January/February 2001.
- [7] Constantine, L. L., and Lockwood, L. A. D.: Software for Use: A Practical Guide to the Models and Methods of Usage-Centered Design. Addison-Wesley, New York, NY (1999)
- [8] Nielsen, J.: Usability Engineering. AP Professional, Boston, MA (1993)
- [9] Shneiderman. B.: Designing the User Interface: Strategies for Effective Human-Computer Interaction. Addison-Wesley, Reading, MA (1998)
- [10] Mayhew, D. J. The Usability Engineering Lifecycle: A Practitioner's Guide to User Interface Design. Morgan Kaufman Publishers (1999)
- [11] Montero, F. Quality and Experience Integration within Model-Driven User Interface Development, Ph.D. thesis, University of Castilla-La Mancha, Albacete, Spain, 13 October (2005)
- [12] Calero, C. Delph-IN: Desarrollo de aplicaciones para dispositivos móviles teniendo en cuenta la usabilidad. Proyecto Final de Carrera. Universidad de Castilla-La Mancha. (2006)