C : P A G P *

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Abstract

In this work we describe our experience teaching an innovative Android programming workshop organized by the Universitat Politècnica de Catalunya (UPC) within the AndroidEDU Google EMEA Program. The growing interest in Android has allowed us to apply proactive learning techniques with very good results. As teachers, this was a challenging experience, that has forced us to rethink our role, to create educational material accordant with the new communication media (forums, YouTube, etc.), and to supply the lack of expertise with an interesting collaboration between teachers and students. After three semesters teaching this workshop, we are convinced that this is an experience to share since the results have far exceeded our expectations.

1 Set Up

Google, within the **Google EMEA's AndroidEDU Programme**[3], launched an invitation to Universities with the goal of promoting the development of teaching experiences using the Android system on google phones.

To participate in the program it was necessary to submit an innovative proposal to develop a mobile engineering system requiring a limited number of phones that, at the same time, could reach a broad audience. The proposed system should be scalable and the proposal should facilitate making computer science more tangible for students. The proposal submitted to the program by some of the authors of this paper was selected. This is the reason why, in order to facilitate its implementation, *Google* granted the ALBCOM group of UPC with 20 Google phones.

That is the origin of the *Programming Workshop on Android Application for Google Phones* with acronym in Catalan TPAAGP. This is a free-choice course that UPC offers to undergraduate students. TPAAGP is aimed to be a very practical 4-ECTS course. The quota of students in the workshop is restricted by the available hardware, thus the course usually has around 20-25 students. Those enrolled students should have a good command of the Java programming language and a good general knowledge of algorithms and data structures.

What we observed while teaching this workshop is the following. First, that students are much more proactive and motivated than they usually are in other more conventional courses. Second, that there is a change on the role of the teacher, since now he/she acts more as a guide (or *coach*) than as a conventional teacher. Third, that this workshop brings new light and vitality to classic contents such as programming and data structures. We claim, therefore, that new technologies can be a useful motivator in some aspects of the University education.

In what follows, we give some details about the course (more information can be found at `http://albcom.lsi.upc.edu/tpagp`) and we develop a little further our impressions of the results.

2 The Course

The course lasts for ten weeks and it has a very practical orientation right from the very beginning. Since the students are supposed to have previous knowledge on Java object oriented programming, the course focus already from the first session on Android's programming details.

TPAAGP is designed to be highly interactive both between professors and students and also among students themselves. The organization is such that each week is devoted to a different topic, that is always tackled from a highly practical point of view, with several different examples and open discussions. In every ses-

sion, an exercise is left as homework for the next session. The complexity of the topics treated weekly gradually increases as the course progresses, and so do the homework exercises. In order to provide a more unified perspective, each exercise incrementally adds new issues and components to the one proposed the week before. In that way, the student is guided during the course on the development of a small application and has a better overview on all the material taught.

The evaluation of the course is done by means of the solutions provided to the proposed homework exercises, together with the development of a more complex project to be delivered by the end of the semester. In that final project the students have to apply the knowledge acquired along the course in order to engineer an efficient solution for a more commercial-like Android application. Both for homework and projects, the students are suggested to work in teams of up to 3 people.

Contents. The course starts with the setting of the programming environment, that includes the installation of a Java Platform (JDK [8], version 5 or 6) and Eclipse [5]. It is quite convenient to work under an IDE platform such as Eclipse because of the possibility of installing the ADT Plugin [1], which significantly facilitates the development and deployment of Android projects. The second session is dedicated to widgets and files, two of the main but simplest components for programming. The next six sessions are the core of the course, they treat the following topics:

- Localization: GPS and Google Maps
- Data Bases
- Menus and Threads
- Internal communications: Intents, Remote Procedure Calls and Bluetooth
- Internet communications: HTTP connexions, web services and browsing
- SMS and call handling

The course finishes with a session about how to publish an Android application in the Android Market [2], and a session on how to manage graphics at a lower level for programming games. Further details on the course program can be found at the website `http://albcom.lsi.upc.edu/tpagp/`.

Bibliographic support. The main bibliographic sources suggested to the students are the following books, although for some specific topics, [6, 7, 4, 9] are also of interest and utility.

- M. Murphy. *Beginning Android.* Apress Ed, 2009.
- Z. Mednieks R. Rogers, J. Lombardo and B. Meike. *Android Application Development.* O'Reilly Media Ed., 2009.

Grading. An exercise is left as homework at the end of every session. The students are supposed to work on it and bring a solution to be discussed in the next session. That homework will conform a continued evaluation of the students and it is worth approximately one fifth of their final qualification.

Towards the eighth session, each group of students is assigned a final project in which they have to apply the knowledge acquired along the course in order to engineer an efficient market-like application. One month after the project assignment, there is a checkpoint session in which the students explain in public their progress up to that moment. The checkpoint session is used to discuss in groups on problems found, solutions, decisions that needed to be taken, etc. After that, the students have one additional month to finish their projects. It is worth mentioning that, from those two months in which the students can work on their projects, one of them is completely free of lessons.

At the end of the semester, the students will have to deliver the code and the documentation of the project that they implemented. On the same day, the project will be presented to an open audience, including a life demo. Additionally, each group will also record in video the presentation of their project and a demo of how it works. In order to give greater visibility to the work of students and provide possible contacts, both in business and in terms of collaborations with other Android developers, a `YouTube` channel has been created, `tpagpUPC`, accessible via `http://www.youtube.com/user/tpagpUPC`. Together with the web site of the course, the channel gives visibility to the course and helps to attract new students. The videos represent a new form of dissemination of work on technology topics. To fully develop it, we claim that future engineers should (desirable) have some specific training in several aspects of multimedia communication.

All the material, including the documentation, is also presented to Google.

3 Impressions and Further Considerations

As teachers, we should say that this course has come as a pleasant surprise. Used to teaching theoretical subjects where, unfortunately, the common student denominator is indifference (at least in UPC), we never expected to find students so motivated and hard-working as in this course. It is worth to note that the initial motivation does not decrease over the course and, in fact, it is consolidated during the final project development, of whose results we are very satisfied. The surprise is even greater when one takes into account how few credits are given to students for this course (just 4 ECTS) given that the overall work done by them is quiet substantial. We should say, also, that the students themselves are really satisfied with the course. They give the course high marks at the polls we pass every semester.

Additionally, this experience has allowed us to take up new educational challenges, forcing us to rethink our usual role. In fact, traditionally we are used to courses in which the teacher is considered an *expert* on the course's subject and is therefore the main source of knowledge for students. This applies, for instance, in teaching well-established disciplines such as programming or data structures. However, in university this is very difficult to maintain (if not impossible) when it comes to a course of advanced technology, such as Android, where commonly professors are not experts. In our case we changed our role from *expert professor* to *coach professor* or guide through learning.

From the university point of view, this course allowed naturally for situations that are very difficult to find in other courses. We refer specifically to the type of course and university-business relations. Although new trends seem to indicate the desirability of a closer relationship between the university and the business world, it is very difficult to find courses that foster it. In TPAAGP, the establishment of this relationship was something that arose spontaneously, not only because of the direct relation with Google, but also because at the end of the course we try to get in touch with a company in the sector.

Moreover, the workshop TPAAGP can be considered an integrator course: not only Android is worked out as a new subject, but several consolidated knowledge from other courses of various kinds have to be applied: programming, algorithms and data structures, operating systems, distributed databases, software engineering, among others. This makes TPAAGP a difficult course but also ideal to confront students with the type of tasks they will probably face in their professional lives.

References

[1] ADT Plugin for Eclipse (http://developer.android.com/sdk/eclipse-adt.html).

[2] Android Market (http://market.android.com).

[3] AndroidEDU EMEA (http://sites.google.com/site/androideduemea).

[4] E. Burnette. *Hello, Android. Introducing Google's Mobile Development Platform*. The Pragmatic Bookshelf, 2009.

[5] Eclipse (http://www.eclipse.org).

[6] C. Collins F. Ableson and R. Sen. *Unlocking Android: A Developer's Guide*. Manning Publications, 2009.

[7] C. Haseman. *Android Essentials*. Apress Ed, 2008.

[8] Java Platform (http://www.oracle.com/technetwork/java/javase).

[9] J. Ledford. *Web Geek's Guide to the Android-Enabled Phone*. QUE Ed., 2009.