Introducing Mobile Computing: Student Built Mobile Databases

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ABSTRACT

This study reports on using Personal Digital Assistants (PDA) as supplemental tools for student projects in an introductory database course. The course has traditionally been taught using a relational database in a PC. This modified course builds on the design approach and adds a Palm based relational database as the deployment component.

PURPOSE

The structure of the introductory database course devotes about eight weeks to database design issues (ER diagrams, normalization, defining business rules) and about eight weeks on application of the theoretical content in building a project. The educational model faculty use for this and most courses in the department is a constructivist approach (Gallagher and Reid, 1981), where students learn the tools then implement those skills in a project. The faculty teaching the introductory course on database design had found that students were limited in applying the concepts to novel situations. To solve this problem, faculty attempted using real-clients. These, however, were found wanting because few projects were of a viable scale for novices to complete during a fifteen week undergraduate course. Additionally, many real world projects involved repeated tasks, such as creating multiple transaction forms or reports, which detracted from the instructional objectives.

Integrating a PDA with database software was proposed to enable students to think differently about database implementation and design. The questions of interest were:

- How would the students implement the Palm as a solution to their database project?
- Would students develop more appropriate databases by incorporating the Palm?
- What was the student satisfaction with the Palm as a component of the course?
- Would the students use the Palm in other ways in support of their academic program?

Given the constructivist model, the primary measure of success in the program was the types of projects the students decided to undertake. Usually students' proposals are wildly ambitious, such as the management database for the student lab services, which would require access to university records for full implementation, or acutely personal, such as a CD or video collection. The course designers, by integrating the Palm hoped to shift the focus to meaningful projects, with a chance of implementation, and possible real-world piloting within the confine of the semester long course. A student survey focused on usage served as a secondary measure.

Rational for a PDA

Two criteria led the decision to integrate a PDA into the database design course. First, it introduced students to field or mobile computing, a growing issue for IT professionals (Hamblen, 2002). Interestingly, a student who worked part-time for a medical billing services company was issued a T-Mobile Sidekick, demonstrating to the class that PDAs were likely in their futures. Second, a PDA introduced students to alternative interaction with computers.

The selection of the Palm was driven by primarily by its dominance in the marketplace (Rubinstein, 2002), its simplicity (Butter and Pogue, 2002),

and its positioning as an inexpensive accessory to a PC. The market dominance meant there were a number of database options and some students were already familiar with the device. Three students already owned Palm OS devices. The Palm's simplicity would minimize the training time. The minimal expense would diminish the costs to implement.

A secondary consideration was to introduce students to an alternative operating system. All courses in the university program use WINTEL computer labs and Microsoft publishes the majority of the software that the students use. With the prerequisites of the course, enrolled students have taken at least three courses all using the WINTEL platform so are familiar with the interface but not necessarily aware of its conventions, limitations, and advantages. The Palm forced students to be cognizant of displaying information in a limited screen size, interacting without a keyboard or mouse, and interacting in an environment without specific file management which required integration with a host computer.

IMPLEMENTATION

The class comprised twenty-two students, of whom three were female and nineteen male. Four of the students had taken part of the course previously but had withdrawn prior to completing; two when the course had been built upon using *Oracle* and two when it focused exclusively on *Access*.

All students were issued a Palm M105 with the basic Palm software (date book, contact list and so on) and additional software including *Giraffe*, a Tetris-like game to teach and practice text input with graffiti (the stylized script for text entry on the Palm), *Tap*, an arts project funded by the DIA foundation (Buckhouse, 2002), and *thinkDb* a database program (DataViz, 2002).[1] Each student had access to a personally owned computer to serve as a host for the Palm. All students were given the Palm desktop synchronization software and *dbSync*, a conduit which allows *thinkDB* databases to synchronize with an *Access* database on a host computer.

Two teams of two students each were designated to assist with the Palm implementation. One team managed the devices and software licenses and served as a helpdesk to answer operational issues, such as performing a "soft reset". The other team served as a helpdesk for *thinkDb* application specific questions including synchronization. Both teams developed and maintained databases for their respective areas.

Familiarization

The *Tap* application, which emulates a tap dancer by selecting from a set of tap dance steps, was used to introduce the Palm devices. This application was selected because it required fundamental Palm concepts, such as tapping to execute commands or select from a list, and beaming to exchange information. Additionally, *Tap* allowed students to think more broadly about the concept of a data than the traditional text and numerical examples, such as a name and address in a phonebook. Each of the steps is a data element and the combinations of data create a specific dance, or information. One student noted that because of *Tap* he considered including images of contracts in his database.

To familiarize the students with *thinkDB* the database software in the Palm, and to make them aware of the differences between it and *Access*, class examples used the same datasets for both applications. In particular, this brought

Table 1: Summary of Student Projects

Project	Description
Fleet Racing	Shows the rotation of boats and crews in a fleet race; includes the results of races, taking into account protests.
Yearbook Production	Records the completion of yearbook pages including the drafting and editorial approval of the final version.
IT Department Trouble Calls	Records and assigns trouble calls to technicians
Truckers Log	Records trucking details for a shipping company.
Real Estate Management	Records tenant agreements and apartment maintenance
Hotel Management	Assigns cleaning duties to maids and records room damage. Field tables in Spanish.
Religious Affiliations	Records religious affiliation and participation for international students
Palm Database	Inventory and help call database
thinkDb database	Help call database

up the differences between the Query By Example (QBE), a unique model for *Access*, and the model for thinkDB which uses categories, filters, and views.

Integration

The project required the students to develop and application with a field component as a means to integrate the Palm into the database design. The architecture of *DbSync* did not permit updating multiple tables in a single synchronization of the Palm and the desktop database. To accommodate this limitation, only one table needed to be deployed on the Palm. This required students to think about the usefulness of the table and its integration with the database. The table could be based either upon the table or the query objects in the *Access* database.

RESULTS

The student databases were developed in teams to build upon collaborative learning and to encourage team relations. Table 1 gives a brief description of each project.

Of these projects, only one, the Yearbook Production, did not include a field component. A modification suggested that a photographer's log would provide a field component. All other projects included a field component and the "Palm" and "thinkDB" databases were implemented as field databases exclusively with the *Access* version serving as a backup.

The Hotel Management project became the most interesting project as it brought up unanticipated issues. The maids in the hotel are all Spanish speaking, while the management speaks English. For this project, the Palm tables were deployed in Spanish with the synchronized tables in the *Access* database in English. This is the first instance of any student project requiring language localization.

Survey Results

The survey attempted to determine student usage patterns and acceptance of the Palm PDAs. Of the twenty-two students, sixteen (73 %) used the Palm for personal use, such as maintaining a calendar or contact list. Nine (41%) reported using the Palm more than once during the day with four reporting that they used it more than five times per day. Ten students (45%) reported adding software in addition to the given software, most of them games. Only three students (14%) felt that the Palm should not have been included in the database class; one commented "not enough time for use" and another commented that it was "too hard to browse." Of the nineteen students (86%)

who were supportive of the Palm, eight commented that it gave them a better understanding of databases and six commented that it was a valuable introduction to the Palm. (Note, not all respondents included a comment).

CONCLUSIONS

The student projects showed greater variety than in the past. The field component did seem to have a positive effect on the projects the students chose and caused them to work with real world problems and real world data. Only one project did not include a field component. One student was sufficiently motivated by the project that he requested use of the Palm during the winter break to develop a fishing log as a Palm database. His goal is to upload the completed database to the Sports area of the DataViz website.

Additionally, students responded positively to the experience with the PDA, despite it being a low end model, with gray scale screen and limited power. Comments such as "…helps students understand real world scenarios" and "…won't be long before palms & databases are always linked together. Important we know how to use" indicate that students found the experience purposeful.

The implementation had three drawbacks. First, the course would be better served if *thinkDB* were able to synchronize multiple tables to allow for reinforcement of the relational concepts. Second, an implementation with a synchronization server through a product such as *iAnywhere* or *DB2 Everyplace* would better model the business environment for students. Third, a full SQL engine in the Palm, as is available for the iPaq/Windows device, would increase flexibility and reinforce those concepts, although at the expense of introducing an alternative operating system.

It was fortuitous that the implementation actively involved the students to provide support to their classmates because the sale by the publishers in early November led to degraded vendor support at a critical time. DataViz now packages desktop development tools along with the conduit, which is an improvement for students who struggled with developing on the Palm itself.

While Johnson et. al. (2002) concluded that handhelds are not yet ready for the college classroom as a substitute for a laptop computer, this study indicates that as development devices, handheld computers may bring benefits at minimal costs and provide better preparation for our students in their careers.

ENDNOTE

[1] ThinkingBytes, which generously provided a software grant, sold *thinkDb* to DataViz in November 2002 who re-released the product as *Smart Lists To Go*.

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