

CHANNELING THE BRICKS-AND-MORTAR LESSON ONTO STUDENTS' DEVICES

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ABSTRACT

This paper describes classroom practices based on interacting with students through their mobile phones, using a minimum of dedicated technology. Students' sense of proprietorship over such devices has led to results that continue to stimulate our current research efforts. The technologically impoverished teaching tactics first devised to fit technology available in the late nineties are still used occasionally to liven up bricks-and-mortar lessons, even as they provide insight into what integration needs are likely to put out payback when implemented using more sophisticated wireless platforms and systems.

KEY WORDS

mobile phones; thin devices; innovative web-based teaching and learning technologies; platform integration; wireless classroom, testing and assessment.

1 Introduction

No one currently teaching in Italy can honestly claim never to have wondered what to do with cellphones in the classroom. Until the late 1990s, discussion among colleagues about "what to do with cellphones" invariably led to the conclusion that "students should be asked to turn them off." The widespread adoption of *telefonini*, whether as fashion accessories, as indispensable marital (and, later, parental) leashes or as extensions of the workplace into personal space, took place so early here that no potential for integrating such devices into classroom technology was apparent. Indeed, when cellphones began cropping up in the classroom, there was often no other technology to speak of, so any thought of convergence would have seemed downright visionary. Even in what were then high-tech classrooms, VCRs, cassette decks, and laser discs were not the kind of technology that lent itself to cellphone convergence. However, the ubiquity of *telefonini* and their enthusiastic adoption by the student-age population certainly made them seem obvious candidates for experimentation as learning devices.

After the Web began creeping into classrooms in 1995 and later, the technological landscape in spaces devoted to teaching and learning changed considerably. The key piece of equipment that changed our answer to "what to do with cellphones" by making new teaching techniques feasible was the networked videoprojector in the classroom, the vi-

tal return link in the impromptu forum and the pop quiz described below. This paper focuses primarily on what we have already done using so-called SMS messages (for "short message system", i.e. "texting") during real-time, bricks-and-mortar lessons. Some other aspects of leveraging students' own cellphones as learning tools and automating assessment events, such as quizzes, are also mentioned. The phone-based exercises described in this paper have been experimented with in English-as-a-foreign-language (EFL) classes, though many of the techniques can be adapted for other subjects.

Until very recently our application of cellphones as a teaching tactic was, in essence, a standalone and occasional classroom activity. We were able to apply some general principles from work with forum systems [1] but did not attempt to integrate the use of mobile devices with our learning management system (LMS) [2]; however, there are now indications that the time may be ripe for a more sophisticated look at how device-bearing students can be networked together. As we have pointed out elsewhere, cellphone features originally designed for other uses, even 'poor ones' such as Bluetooth, can, at least experimentally, be used to create a mobile-computing environment [3]. While this would still not take us to the level of sophistication possible with truly networked cellphones in a carrier-based system like I-Mode [4], a classroom ad hoc network could also be linked into an access point [5] to provide access to the broader network, thus enabling various forms of integration with systems that are not necessarily specific to wireless activities.

2 Focusing on the phone

The potential role of the phone in the classroom was called to our attention not only because these devices were literally clamoring for attention but because of the relationships that students carried on both through the device, which was to be expected, and with the device itself, which came as more of a surprise. As phones became cheaper, and ended up in the hands of younger and younger people, students not only used them for talking and texting but were often observed entranced, killing time playing Wall Breaker or some other game locally resident on their cellphones.

The game-playing attraction of cellphones used as personal devices can be applied to learning activities. One example of how this can be done, which we have tried out

in EFL classes, consists of vocabulary-building exercises designed to take advantage of what might be called “T9 anagrams.” In order to facilitate texting, nearly all modern cellphones in Italy come equipped with a system, known as T9, that provides the user an alternative to multitap. In other words, when the phone is set to use T9, there is no need to press a key multiple times to type a C rather than an A. Rather, the combination of one press on the “2” button and a given number of presses on other keys will enable the phone to ‘guess’ what recognized word or word segment for the desired language is being typed. The longer the word, the more likely the phone is to correctly guess what word the user wants. Ambiguous strings of numeric input leave the user to choose from a list of possibilities. For example, in T9 English, the string 24453 generates a selection of three choices: *child*, *agile*, and *chile*.

We have experimented with using this feature of the devices for English-class activities in two ways. The simplest is to anagram a list of vocabulary items into their T9 homographs “router” into “potter,” “socket” into “pocket,” and so forth. Because of the way T9 works, the anagrams need not be actual English words (though of course it is more fun if they are) and not all the vocabulary that needs to be taught will necessarily have real-word anagrams. Because learning a list of vocabulary items, or even simply going through one as a warmup exercise for a subsequent reading passage, is a notoriously boring task, it comes as no surprise that the chance to interact with the device and the guessing element involved greatly increase student willingness to learn a list.

A variation on this exercise involves mixing the keywords with context, for example in fill-in-the-blanks sentences. If the words to be filled in have not previously been taught, such exercises tend to be prohibitively difficult. A typical approach is to provide a reading passage that contains the vocabulary items before asking students to use them to fill in blanks. However, in a technical field such as computer science, where many such words are actually already part of students’ passive vocabulary, it can be fun to give the fill-in-the-blanks questions directly, ‘translating’ the missing words in a cloze blank into numeric T9 strings. Even in context, it is generally difficult for a human being to envision the possibilities for a string like “24453” because for each number there are three or four possible letters. Students have proved to be very receptive to such games, which can be played even with no blanks at all. We have used this to review the syntax that was being taught. For example, the teacher can write “469 5664 4283 968 2336 78839464 3645474?” on the board and allow groups of students to race each other in ‘guessing’ that the sentence is “How long have you been studying English?”

Another exercise we have tried uses the voicemail recording feature offered by the cellular service provider. Competition among carriers led many of them to introduce easy-to-use services that subscribers sign up for and allow any voicemail message left at the subscriber’s number to be forwarded to her or his email address. Asking students to

pair off and interview one another will thus automatically generate a series of ‘homework papers’ in the form of .wav files. While this enables the teacher to check the pronunciation of each individual student, including those who are usually too shy to talk in class, there is no automation advantage compared to correcting a comparable number of essays. This is essentially nothing more than transfer of the one-to-one communication found in student writing that is read only by the instructor into the spoken medium. The T9 exercises, though we have made them into games to be played by groups in class, are essentially individual exercises that could be conducted with an exercise book, in a language lab or at a self-access terminal. Cellphones’ real potential as a teaching aid lies in using the phones as community devices.

3 Texting in class

When students with only a vague recollection of society without cellphones began to come of age and enter the university, it was clear that the generational change brought with it a change in the very essence of the social group, reflecting the universal possession of mobile phones. At first blush, texting would appear to be primarily a one-to-one channel, much like email; however, the reality is that the on-the-go nature of this realtime, mobile communication medium has led it to become part of the group experience. This surprising finding is noted by Rheingold with reference to studies in Finland [6] and, while texting may be less group-oriented in Italy, there can be no doubt that shared text messages often penetrate at least to the periphery of any group of young people, such as that constituted by students in the same class.

Noticing the readiness with which students would text each other during class, not only in an attempt to exchange answers to a test but even to make asides, including observations on a certain point that had just come up during the lesson, it occurred to us that such interactions, in addition to be treated as destructive distractions or attempts to cheat, might be integrated into the rest of the lesson. A free-form forum exercise was thus devised using the videoprojector. For early versions of this exercise, we set mobile-service options to forward all text messages sent to the instructor’s phone number (actually a special number acquired just for this purpose to avoid any unexpected midnight calls from cramming students) into an online mailbox. The online mailbox was actually a forum on our FirstClass [7] server, taking advantage of two features this offered over some other systems: the message list updates automatically (i.e. all messages are pushed) and a few simple clicks will not only order messages but also group them, for example according to sender. Because students had been divided into groups of two to four (depending on class size), grouping messages by sender would place all of each group’s input into one block. Most SMS text messages were short enough to be displayed in their entirety in the subject line, thus allowing a view of the entire class’s contributions at once (at

least for the most recent 25 messages or so.

Like the more individually oriented exercises described above, this system essentially made the most of extremely poor technology by taking full advantage of the server-side processing power offered by the carrier's SMS-to-email service and our department's Community Informatics Lab [8], which runs a huge local online community housing the Milan Civic Network (Rete Civica di Milano or "RCM") [9]. The latter relationship allowed us to optimize mail-handling features for the forum used during such exercises and integrate user-group permissions with those used for the existing, wired class forum. Thus, the only on-site technology needed to run such an exercise consisted of the networked PC at the podium, connected to the projector, and the students' own cellphones. Because students were grouped, each group could easily be organized to include at least one student for whom sending such text messages would not represent significant expense. Indeed, many students in the late 1990s and very early 2000s had signed up with their mobile service providers for the free texting plans that were then being offered (in an era when carriers were more concerned about expanding customer base than limiting churn rate).

Using such a system, the temptation to engage the groups of students in a race to see which group could come up with the first correct answer to a question had to be resisted because the cellular provider's text-to-mail system had too much inherent latency. Typically, the teacher would post questions requiring one-sentence answers or set each group to producing a series of one-sentence answers to its own list of questions. For example, in one edition of this exercise, an outline of biographical information was given, about a dozen questions in all, with the specification that all answers had to be in full sentences, i.e. "so-and-so studied ⟨subject⟩ at ⟨institution⟩," rather than simply "electronic engineering, Berkeley." Each group was then given a different name of an internet pioneer for whom to fill out the 'who's who' data. Because the class had previously done several reading assignments on these famous innovators, students were able to look up the information needed by referring to notes and handouts.

Incredible enthusiasm Two main aspects of student reaction to this kind of ad hoc forum exercise convinced us that we were onto something. First, it is hard to adequately convey the heights of enthusiasm to which students could be carried by this simple exchange of information. Writing on the blackboard for the entire class to read can prove inebriating. On several occasions, we have literally had students begging for another round of the 'game.' The combination of outward-bound one-to-many messages, originally shared only among the three or so students doing the transmitting, and participation in the audience as it receives those messages creates a great deal of excitement. The fact that the sender of the incoming message appears only as a number adds suspense to its reception as the other groups in the class vie to see who can be the first to figure out, by

comparing the phone number with previous messages sent by the same group, who the sender was.

Second, it is stunning how an ad hoc forum like this can cover the stages of evolution seen in newsgroups and online fora. For example, the first messages that represent noise, usually appear within 45 minutes of the start of the exercise. These typically take the form of some sort of advertising of unsolicited opinion or promotion. Soccer is very popular in Italy and the first off-topic message is often a slogan dear to those who root for a certain team. Because there is heated rivalry among soccer teams, it takes only one such message to draw numerous replies from rival team's fans. Students are likely to begin sending messages at such a pace as to literally overload the human end of the system, i.e. messages begin pouring in faster than it is humanly possible to read them. Other behavior that recalls what one finds on Usenet, for example, includes, if not flaming, at least marginally acceptable messages about classmates or messages of the "for a good time, call" variety. On a couple of occasions, the teacher has had to shut down the system (by returning the image being projected to a slide for the course) to bring such behavior to a close. Another clever ruse that some smart student usually comes up with is the (relatively) anonymous message. This is easily accomplished by using a cellphone that has not until then been participating in the exercise, and is the functional equivalent of writing to a listserv from a different email address.

Lest all this sound terribly destructive, a few observations are in order. The teacher need not relinquish control. Once she or he knows what to expect, it is enough to pilot the output by administering the needed amount of course-related input. The groups will be intent enough on the coursework that they will forgo antisocial messages. In addition, when an EFL class consists of students with a common first language, any controversial discussion is likely to become so swept up in the subject that it will slide back into the common language. When the discussion has to be carried on through texting, the target language appears much more resilient, at least in our experience. Finally, the most important brake on outlandish behavior is the public nature of what is written. Because the entire class reads it immediately, disapproval is very effective in discouraging destructive behavior. The enthusiasm generated makes planning to avoid such pitfalls well worthwhile. In addition, discussion can be saved, continued in the forum, and discussed in future lessons.

4 Pop quizzes through texting

In recent years, we have adopted a technologically alternative approach to a slightly different sort of classroom need. The change in technology has reduced the latency that proved such a limitation in using the real-time SMS display described above. Cellphones, typically equipped to Infrared Data Association (IrDA) specifications, now interface much more easily with computers than in the past

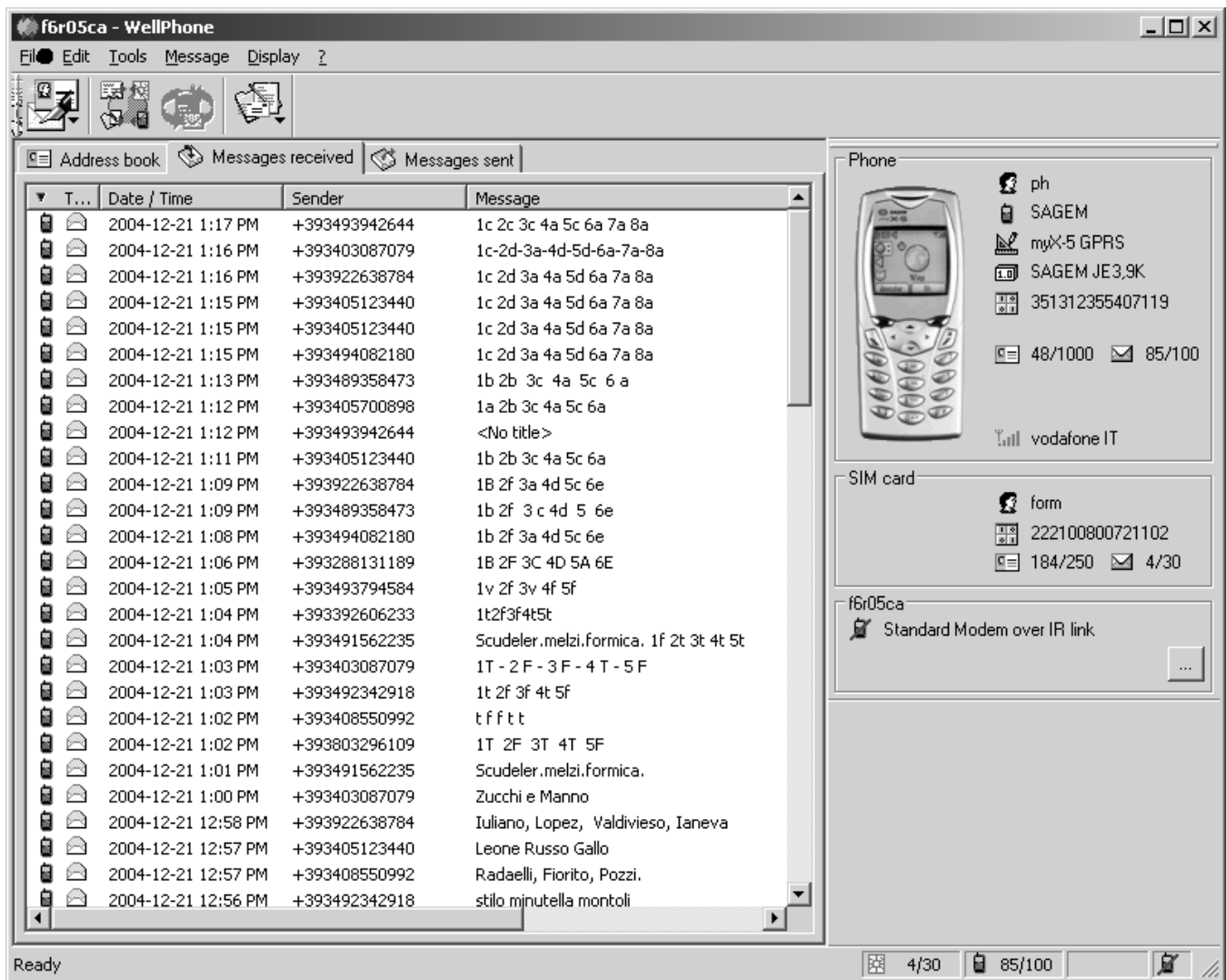


Figure 1. The handset-manufacturer's PC-interface software becomes the blackboard during a pop quiz.

(when PC connection often required a cable with proprietary connectors and a price to match) and most handset manufacturers offer phone-management software that can be set to poll the phone for newly arrived text messages at a very short interval (say, five seconds). Figure 1 shows a screenshot of such software for managing a Sagem brand handset. Comparable packages are available for other brands. This software, preloaded onto the laptop to be used during the lesson, is projected onto the screen to conduct a pop quiz with a large group of students. The system seems to work well for a class of about fifty, i.e. some 15 groups. It can be done as an individual exercise but our experience shows it to work better when more than one student is behind each phone. This also has the advantage of allowing the students to sort out among themselves who will be transmitting (and thus incurring costs of perhaps seventy eurocents during the lesson).

At the beginning of the exercise, the instructor announces that there is to be a pop quiz via SMS, puts the

phone number up on the board (actually a blank word-processor document), and asks the students to form groups of three. These instructions may include the specifications that, of the three, one should be skilled at multitap, preferably with the same mobile provider as the instructor (to reduce latency) and be nominated typist for the group. Multitap is the alternative system to T9 which allows the user to type in an exact string with no help from the device's guesswork by pressing, for example, the "2" key once for an A, twice for a B, three times for a C, four times for a 2, and so forth. Each group sends an initial message containing the names of the students in that group. These are the messages at the bottom on the screen shot, i.e. the earlier incoming messages in an example of this exercise that lasted about forty-five minutes in all (the segment from 12:56 to 1:17 is shown in Figure 1). This information is thus available to the class to see who is who and to the teacher, afterwards, to match students with their group's answers. The screen shot involves an exercise with six groups of two to four

students. (During an actual lesson the phone-information panel would be turned off so as to display a longer string in the message field.)

As can be seen in the figure, the earliest messages (bottom of the screen) are these informational items with students' last names. At 1:00 pm, the instructor gave out the first series of true-or-false quiz questions. The group whose first member is Scudeler had not yet seen their first message appear when they received the quiz questions (which were the same for all groups in this particular exercise). As a result, they sent their names up again along with their first answer set. Questions in the first set were numbered one through five, each of which was to be identified as true or false (i.e. "t" or "f," though "v," for Italian *vero* was an acceptable equivalent to "t.") The correct answer to this question set was thus "1t2f3f4t5f" or some variant with spacing.

In the segment shown, two subsequent multiple-choice question sets are then dealt with in a similar fashion. The fact that there are different answers reflects the tendency of students to place greater emphasis on speed than accuracy. Although they were not told to try to turn in their answers quickly, the temptation to race was part of the general feeling. Shortly after the topmost visible message, having posted the answers to the last question set, the students began to exchange season's greetings because this was occurring on the final lesson before winter break. Remarkably, most of these were in English, although the variety of spellings of the word "merry" left at teacher little to be proud of. In essence, here, the cellphone has been applied to a function partly equivalent to that of a classroom clicker [10], a kind of device not much used in Italy. There are, however, two important differences: unlike a lesson using clickers, answers become immediately visible to the entire class and these answers need not be limited to a pre-defined set of answers such as "true" or "C". The latter factor is what enables the students to use a system like this for carrying on a class discussion *ad libitum*.

Not only does a system like this permit the instructor to see what needs to be gone over again, as would the results of a standard on-screen or paper-based test, but, by virtue of its openness, it increases students' awareness on what their classmates are having trouble grasping. The public nature of the results naturally tends to draw students into discussion of why the right answers were the right ones. This affords an ideal opportunity to go over key concepts that have not been properly assimilated. Because at least one group posted a variant answer, students will voluntarily set to work trying to prove their claim. In defending their answer and trying to bring the other students around, the students re-create a helping-hand spirit not unlike what prevailed in the early years of the internet. This further serves to focus attention on why which answer was chosen, often with a great spirit of solidarity between groups that were - only moments earlier - intent on competing with one another.

5 Discussion

This stimulating exercise is clearly not one we choose to use for every lesson. Rather it is something to be kept for a special occasion. However, it provides a refreshing break from other quiz forms and proves to be a memorable experience for the students. By contributing to the sense of community it puts into place mechanisms of group awareness that help create a cohesive class unit out of a large unwieldy group of first-year computer-science students (though, obviously, it could be employed in other fields as well).

Nevertheless, there is no denying that such a method cries out for automation and improvement. For example, upon completing the class exercise, the instructor must export the data from the lesson (as a comma-separated values file) and import it into the spreadsheet application in order to take advantage of any sort of automatic grading or scoring. This is just one of many integration needs that we are working on systems to satisfy, starting from the premise that we wish to leverage students' own devices.

Assessment integration Much of our previous and current work on other aspects of technology support for education, especially suited to the mix of private equipment and institutional facilities that we have in Italy, has centered on applying an Apache-MySQL-PHP learning management system to testing needs and distance learning; see [2, 11]. Naturally, being able to integrate in-class, thin-device quizzing with other assessment events is very attractive. In one sense we are not far off: by applying principles of authentication-layer database integration as in [11] we should have a relatively easy time of getting the wireless activities to blend into a larger system. On the other hand, devising something like this to work with the devices that students currently carry, i.e. cellphones, will require a very flexible approach.

Forum integration Following an exercise like the one described, the record of the class conversation is not necessarily compatible with the creation of separate forum messages on the platform of choice for a given course. A second issue with fora is the need to use a wired terminal for forum access, rather than, say, checking back into the conversation on the bus home from class. These issues will really only be solved when we are able to network the devices together using something other than the carrier's mail-forwarding service.

Multimedia integration There is also clearly potential for using the cellphone as a mobile microphone, especially in language classes, for capturing and storing students' interviews of each other or small-group discussions. Ideally, these would then become accessible for immediate playback in class, as well as deferred listening as podcasts. And aren't cellphones becoming video cameras, too?

6 Conclusion

Pride in their devices Though it is becoming less true as the novelty of cellphones wears off, one of the factors resulting in increased student enthusiasm during lessons that made use of cellphones is the pride students show in their devices. This is not so much a matter of wanting to show off one's hardware as of being proud to be addressed through the device because this represents a user-controlled, centralized interface for social interaction. On a group level, it is also clear, as has been observed in other circumstances where handheld devices were introduced into the classroom, that such tools can turn "some typically individual activities into learning opportunities involving substantive discussion and peer-to-peer learning" [12]. For this reason our needs and potential start from the features found on the devices we can expect our student population to be carrying.

Direct communication among students An additional lesson from these experiments, in particular from how students reacted to this use of technology, lies in the importance of providing a podium for one-to-many discourse that allows individual students to express themselves. This would appear especially vital in terms of linking the student experience to the physical environment, and vice versa, so as to make the people part of the *genius loci*. Understanding this need has led us to give higher priority to features such as RFID graffiti [13] in our current design plans. We also realize, however, that it will not be enough, didactically, to integrate student ideas into the place; feedback mechanisms will need to be set up so that teaching tactics take a leaf from the playbook of students' communication practices.

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