Hadeda: The Noisy Way to Practice Spelling Vocabulary using a Cell Phone

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Abstract: With the push to better school results in mathematics, science, and technology related subjects, often language education is moved into the background. In Africa, however, education is often not in the mother tongue of the learners. Pupils are in a position where they are trying to learn complicated subjects such as science and mathematics in a language which is not their home language. In some African countries, there are dozens if not hundreds of languages. Hadeda is a project where primary school pupils (and even secondary school pupils) are encouraged to practice spelling words or vocabulary words using their cell phone. Hadeda allows the language teacher to create spelling lists or vocabulary lists in English and Afrikaans. Hadeda then generates a fun cell phone application using multiple text-to-speech engines to encourage pupils to practice spelling the words.

Keywords: spelling, language, cell phones, TTS, HLT

1. Introduction

Africa is a mixture of first world and third world societies. Africa has many areas where a foreign visitor could assume that he or she is in a booming first world city; then, a few blocks away, the visitor would find a third world neighbourhood which may not have plumbing or electricity. Within an African urban area, neighbourhoods may speak a variety of languages. African countries often have "official languages" which are not the home language or mother tongue language of any of its citizens, and, of course, to be able to effectively compete in the world market, English is a mandatory language. Yet amid this linguistic, social and economic chaos, the cell phone is everywhere.

Language education is important in Africa. For educational reasons, pupils often have to be fluent in a second or third language in order to attend university. For economic reasons, citizens often need to learn a business language such as English, French, or Portuguese. For political reasons, citizens often need to learn the language of the majority of voters in an area. For social reasons, people often need to learn the language of their neighbours.

It has often been said that the cell phone degrades language skills. Teachers, educators, and parents have often complained that children who use cell phones extensively forget how to spell words or they spell words without vowels or they exchange letters such as "o" (oh) or "l" (ell) with numerals such as "0" (zero) or "1" (one).

The objective of Hadeda is to determine if cell phones can be used to assist in language skills. It is a spelling practice system where a teacher can create spelling lists or vocabulary lists in more than one human language. A funky cell phone application is generated which can be downloaded by the pupils onto their cell phones. The cell phone application will

audibly speak the vocabulary words to the pupils. The pupils can then practice their spelling lists or vocabulary lists on their own cell phones.

2. Language Learning and Cell Phones

Language learning and technology have a history of integration. This relationship had its inception with the advent of recording, playback and broadcast technology to provide authentic speech samples. The use of the technology has matured with the prevalent educational theory of the day progressing from language laboratories to drill based computer-assisted instruction, influenced predominantly by behaviourism. This was replaced by more intelligent and interactive multimedia computer assisted language learning. The availability and use of the Internet has lead to the development of computer-mediated communications and the stage seems to be set for the integration of mobile technology [1].

Educational researchers argue against a "technology-driven pedagogy" [2] and emphasise the importance of designing educational language learning environments ahead of deciding on the technology [3] warning that practitioners "need to be concerned about investing time and money in unproven technologies" [4][1]. For this reason the MobiLED initiative (of which Hadeda is a part) has adopted an activity based design framework that aims to facilitate the potential of the technology and the demands of the pedagogy to enable workable educational platforms [5][6].

There exist various examples of language learning initiative utilising mobile phone technology. These initiatives range from the phone assuming the role of instructional tool, tutor and communication/administration device. The mobile phone has been used to present and facilitate vocabulary training and lessons, quizzes, phrase translations, SMS instruction, class room polling and to support task based learning to name a few [7][8][9][10][11][12][13][14][15]. Very few of these initiatives however have focussed on primary and secondary school education.

3. Technology Description

Hadeda combines a wide range of ICT technologies. In general, however, the technologies can be grouped into three sections:
1   Web interface to allow users to make and deploy spelling lists: This web interface allows teachers to enter spelling words or vocabulary words using either the cell phone browser or by using an internet based workstation.
2   HLT (Human Language Technologies) facilities to generate the sound files for the spelling words: Both FreeTTS and Espeak are used to take the spelling words or vocabulary words and create audio files.
3   Cell phone application or midlet that can be downloaded onto the cell phone: The cell phone midlet was developed using Sun's Wireless Toolkit and is packaged by the web application.

Figure 1 shows the interaction between the major components.

Teachers can access the Hadeda Server using either their cell phones or internet based workstations. Teachers can type in the words for the spelling lists or vocabulary lists using a Tomcat based web application. Depending on which human language is selected (currently English, Afrikaans, Swahili, French, and German), an appropriate text-to-speech engine is used to generate the appropriate sound clips (See section 4 below for more detailed information about the TTS facilities). The sounds clips are originally in *wav* format. *Wav* format, however, is not playable on all cell phones (especially some of the older models) and the format is quite large. The Tomcat application converts the *wav* files

to *amr* format, which is often a tiny fraction of the original size. (See section 5 below for more detailed information on how this was done).
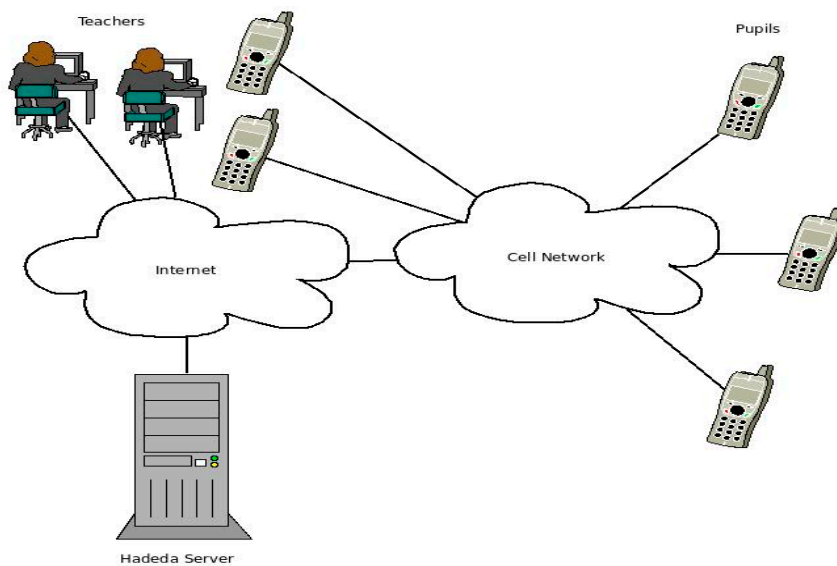

Figure 1

The sound clips are combined with the Hadeda midlet (or cell phone application software) along with some configuration files. A downloadable Java midlet is hosted on the Hadeda server from where pupils can download the midlet onto their phones. Once the midlet is on the pupils' phones, the midlet can be played even when the phone is not within range of the cellular network.

4. Text-to-Speech

Two different text-to-speech facilities are used to generate the sound clips of the spelling words or vocabulary words. FreeTTS is used for the English words. Espeak is used for the Afrikaans, French, Swahili, and German words. Both FreeTTS and Espeak are available free of charge and do well at generating the correct pronunciation for words. Hadeda is written in such a way that it will be easy to add other languages once a TTS has been created for that language.

Both FreeTTS and Espeak utilities generated *wav* files. The *wav* files, however, are often between 20K and 30K bytes. For example, FreeTTS generated the word "dog" to a file which was 27330 bytes. Espeak generated the word "Hond" to a file which was 24534 bytes.

This size is uncomfortably large for cell phone applications. A combination of *sox* and *amrnb* is used to reduce the size of the sound files.

5. Sox and amrnb

Cell phone applications need to be small in size. There are a number of reasons for this but two of most important include:
1   Cell phone applications are typically downloaded over the air and the pupils will have to pay for the download airtime. In South Africa, data packets are charged at approximately R2.00 (at the exchange rate at the time of writing this paper, R10.00/US$1.00, that comes to twenty US cents) per megabyte. We wanted to make sure that the pupil would be able to download a spelling list for less than 50 South African cents (approximately 5 US cents).

2   In addition, many cell phones have a limit of 300K bytes for a cell phone application. We wanted to ensure that Hadeda would stay within the size limits of the majority of cell phones in use.

With those two restrictions, having *wav* files of 25K bytes would limit our application to approximately 10 words – whereas a typical classroom setting has spelling lists or vocabulary lists of usually 20 words. *Sox* was used to convert the *wav* files into an intermediate raw format. And then the *amrnb-encoder* was used to change the raw format into *amr* format.

Using these two utilities, the sound file for "dog" which was originally 27330 bytes, was shrunk to 440 bytes. The sound file for "hond" which was originally 24534 bytes was shrunk to 552 bytes.

6. Java Midlet and Web Deployment

The original Java Midlet for the cell phone application was developed using Sun's Wireless Toolkit. The midlet was written in such a way that it reads a configuration file for the list of spelling words or vocabulary words and the associated sound files. The Hadeda web application merged the *amr* sound files along with the Hadeda midlet creating both the *jad* and the *jar* files required for packaging it so that it could be easily downloaded onto cell phones.

7. Ethics and Safety

The Hadeda project team was constantly aware that the users of the Hadeda midlet would be minor children often as young as 5 or 6 years old. The safety and emotional well being of these minor children was of utmost importance to the Hadeda team. The following steps were taken to ensure that Hadeda did not dispense vocabulary that was not appropriate for these children:
1   Only parents or teachers who are registered with the Hadeda Server can create and publish spelling lists or vocabulary lists.
2   Any parent or teacher who creates word lists that are not appropriate for minor children can be easily removed from the system.
3   No digital record of children's cell phone numbers are stored on any Hadeda Server. The children's identities are not captured by the Hadeda system.

The Hadeda project was submitted to the Tshwane University of Technology's Ethics Committee and prescribes to the principles of voluntary participation, informed consent, and anonymity of participants.

8. Pedagogy

Drills by nature are more of an objectivist methodology and are primarily used to provide practice while constructivists frequently refer to them as the epitome of instructivist approaches and have stated that they should never be used [16]. Many educational theorists are very critical of drills, claiming that they do not capitalize on the potential of the technology [17][18], which in our case could very well be justified criticism, however the success of mobile applications are often found in their single functionality and the ability of the technology to support it. Roschelle [19] suggests that "research attention should be directed at identifying those simple things that technology does extremely and uniquely well, and to understand the social practices by which those new affordances become powerful educational interventions"

Drills as part of the educational intervention and in combination with other methodologies, provide practice and are "useful for learning information in which fluency is required, such as ... spelling and language usage and vocabulary" [16]. Hadeda does not intend to present learners with new information, and we envisage that in will be preceded by instructional methodologies that present and guide the learner through the initial acquisitions of the needed skills to enable them to benefit from the drill and practice.

9. First Pilot

An iterative approach will be followed in order to adapt and test the application in education.

The first pilot was held at a private English speaking primary school in North West province of South Africa. The school policy at that time was that children could bring their cell phones to school but they could not use them during school hours. The pilot was held during November, which is the end of the academic school year in South Africa and the school relaxed their cell phone policy for this period of time.

This pilot was primarily a technical pilot to evaluate the Hadeda application on a wide variety of cell phones in a realistic environment with children of the target age group. Pupils from grades four through seven voluntarily took part in the pilot with full parental knowledge and written permission. During the first pilot, the teachers at the primary school provided the spelling words and the authors of this paper added the spelling words to the Hadeda server through the web interface. In view of the fact that the first pilot was to primarily test the cell phone application, the teachers were not involved except to hand out permission forms and information packets about Hadeda. The authors of this paper met daily with the participating pupils for half an hour (and sometimes an hour) everyday before school started.

A number of technical issues arose and Hadeda was modified appropriately during the pilot phase. These include:

1. Some extremely old phones that the pupils had could not play sound files at all but the pupils were enthusiastic and wanted to use Hadeda. Originally, the Hadeda software would attempt to play the appropriate sound files and if that failed, it would merely print out an appropriate error message. We modified the cell phone application so that if the phone could not play sound files at all then the original spelling of the word would be displayed for a few seconds. The word would be erased from the screen and the pupils would still be encouraged to type in the correct spelling of the word. This slight modification allowed us to reach more pupils. This simulated the "old style" spelling practices of looking at a spelling word, covering it up, and then writing it on paper.

2. Some phones could not handle diacritical marks on letters and, therefore, could not handle words such as the Afrikaans "môre" or "sê". On further investigation of the individual phones, it was determined that these phones did not have the appropriate character sets loaded. The Hadeda application was modified again to test to see if the appropriate character sets were available on the phone. If the character set was not available, then the application would strip off the diacritical marks from the word and display large warning signs on the cell phone screen. The pupils, however, could still practice spelling the words without the diacritical marks.

In addition to these technical issues, a number of "softer" issues were encountered which will be addressed in future pilots:

1. Pupils are extremely attached to their cell phones often viewing the cell phone almost as part of themselves. A number of participants felt embarrassed when Hadeda did not originally execute on their phones. One of the extremely young participants actually

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cried when the Hadeda software would not originally run on her phone. In future pilots, we will have some spare cell phones available for pupils to use (at least during the group sessions) in such cases.

2. Pupils are more than willing to help others use cell phones. Pupils with more experience configuring cell phones and connecting to the Internet are happy to help less experienced pupils. In future pilots, we may wish to chat with the more experienced pupils the day before the pilot starts and actively get them to assist us in configuring phones.

3. Pupils told their friends about the pilot. During the two weeks we were at the primary school, more and more pupils came with cell phones to be configured. In view of the ethics clearances, it was imperative that children brought their signed parental consent forms. Pupils, being pupils, forget. As the pilot progressed, there were more participants. In future pilots, we will remember this and this will ensure that we have enough documentations, etc, for all the participants.

10. Future Planned Pilots

A second educational pilot is planned for early 2009 academic year. This will be in a private English speaking school in Gauteng province of South Africa. This planned educational pilot will be held in a German language class. The participants in this educational pilot will be learning German as a second language or as a third language. The objective of this pilot will be to determine the educational benefit to using Hadeda in a language environment.

More information about this educational pilot will be available at the presentation of this paper in May 2009.

11. Conclusions

Technology, in this case mobile phones, are not in themselves instructors, rather, they are instructional tools and the success of a useful educational tool would be to what extent is supports the activities of the educators and learners in diverse teaching and learning environments. Hadeda is a single function tool that endeavours to support the drill and practice of spelling and vocabulary using technology that is available and known to learners.

From a technological point of view, Hadeda has been successful in what it set out to do – allowing spelling lists or vocabulary lists to be created in more than one human language, generating the appropriate sound clips, and packaging and deploying a cell phone application to allow children to practice these spelling words or vocabulary words. The two technical problems which were encountered on the pilot (phones which could not play sounds and phones which could not display diacritical marks) were overcome by modifing the Hadeda cell phone application to test for these problems and execute slightly differently in such cases.

12. Going Forward

The Hadeda team plans on continuing the development of Hadeda. Our plans include the following:

1 Implement another indigenous African voice
2 Allow the Hadeda midlet to remember the previous marks of a pupil to encourage the pupil to practice words more diligently by showing improvement ie incorporating a game element.
3 To allow educators to keep track of scores obtained by learners.
4 To allow learners to incorporate their own voice and visual clues.

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