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# ALEX – Supporting Low-Literacy Adults through Mobile Computing

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## Abstract

Basic literacy skills are fundamental building blocks of education, yet for a very large number of adults tasks such as understanding and using everyday items is a challenge. While research, industry, and policy-making is looking at improving access to textual information for low-literacy adults, the literacy-based demands of today's society are continually increasing. Although many community-based organizations offer resources and support to adults with limited literacy skills, current programs have difficulties reaching and retaining those that would benefit most from them. To address these challenges, the National Research Council of Canada is proposing a technological solution to support literacy programs and to assist low-literacy adults in today's information-centric society: ALEX© – Adult Literacy support application for EXperiential learning. ALEX© has been created together with low-literacy adults, following guidelines for inclusive design of mobile assistive tools. It is a mobile language assistant that is designed to be used both in the classroom and in daily life, in order to help low-literacy adults become increasingly literate and independent.

## Keywords

Mobile computing, interface design, educational interfaces, mobile learning, assistive technology.

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### **ACM Classification Keywords**

H5.2 User interfaces: Voice I/O, Natural language, User-centered design, Evaluation/methodology. K3.1 Computer Uses in Education: Computer-assisted instruction.

### **General Terms**

Design, Experimentation, Human Factors.

### **Background**

In 2000, nearly 25% of adults (aged 16 to 65) in the world's richest countries were reported to be functionally illiterate [7]. In Canada, 50% of adults are considered to have low literacy skills [6]. For these, understanding everyday items such as bus schedules, food labels, news articles, or medical information is a challenge. This has serious consequences for the economy – businesses are struggling to find local workers who have the basic skills necessary for the demands of today's information-centric society. Several solutions are proposed that provide reading assistance to low-literacy adults, ranging from audio-visual interfaces [3] to applications converting text into simpler forms [8]; however, economic analysis suggests that increasing adult literacy is essential to improving low-literacy adults' work performance and quality of life [2]. Unfortunately, basic adult education is often seen as marginal to compulsory schooling. Community organizations offer resources and support to adults with limited literacy skills, but barriers such as work, lack of financial resources, childcare, and transportation often prevent potential learners from taking part in and benefiting from such programs [1].

The portability and affordability of mobile devices offers a realistic opportunity to provide novel, context-

sensitive literacy resources both within and, more importantly, outside community programs. At the National Research Council of Canada (NRC), by actively involving adult literacy students and literacy facilitators in a series of focus groups and participatory design sessions, we developed ALEX© – a mobile Adult Literacy support application for EXperiential learning (Figure 1 and detailed in [5]). ALEX© is designed to facilitate, in a manner sympathetic to the needs of functionally illiterate adults, a series of language-related support tools. Our ultimate goal for ALEX© is that it will provide practical support to functionally illiterate adults in their daily life experiences and, in so doing, allow such adults to push beyond their comfort zones to become increasingly literate and independent.

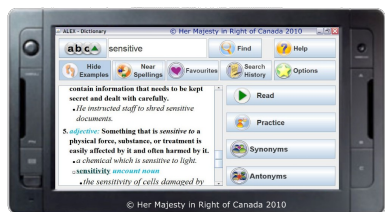
### **A Mobile Approach to Adult Literacy**

New Brunswick is the Canadian province with the largest percentage of adults with low literacy levels. As such, the NRC has partnered with Government of New Brunswick's Community Adult Learning Services (CALS) to address the adult literacy problem in this province. CALS is a network focused on adult learning, including computer, literacy, and workplace training. ALEX© is one of the outcomes of this ongoing research partnership.

### **Overview of ALEX©**

ALEX© is a mobile application that is designed to assist adults enrolled in literacy programs or workplace essential skills training. It is designed to be used in an assistive capacity during everyday literacy-based tasks or in conjunction with formal adult literacy or workplace essential skills training – from classroom exercises, to homework, to any other activity involving reading or writing (such as reading the newspaper, trying to make

ALEX runs on an Ultra-Mobile Device, such as the 7"-screen Viliv X70 (<http://www.myviliv.com/eng/>).



ALEX facilitates learning through:

- complete English dictionary with word usage examples
- audio spelling: text-to-speech reading of complete dictionary entries or individual words
- pronunciation practice: built-in automatic speech recognition that scores users' pronunciation of words
- synonyms, thesaurus
- near spellings: displays words that have similar spellings with the looked-up word; useful in both showing alternatives for misspelled words and presenting users with more choices when they are not sure of the correct spelling of a word
- word lists: favorites-type user-defined lists of words.

sense of a safety notice posted in a public space, writing a letter or filling in some documents at home).

The ALEX© interface was developed according to the guidelines for inclusive design of mobile assistive tools [4]. The principles that were followed included multimodal output (text and speech), suggestive labels for buttons, instructions worded in simple language, soft keyboard with both alphabetic and qwerty layouts, and the use of a dictionary with definitions of appropriate literacy level for the target population.

ALEX© is designed to help develop language skills and knowledge acquisition pertaining to real life by providing intuitive access to various language-based tools, as shown in Figure 1. Furthermore, it helps students develop other essential skills in conjunction with literacy skills, such as computer usage and information-focused thinking. ALEX©'s aim is to increase students' independence, to empower learners outside of a classroom, and to adapt to and meet different needs of different learners. It is a useful assistant not only for students, but also for teachers,



Figure 1: The main interface and features of ALEX©.

by providing them with an additional tool to enhance the classroom experience.

The goal of the ALEX© research project is to explore how adults enrolled in literacy programs and workplace essential skills training can benefit from a mobile assistive technology that supports experiential learning, and furthermore demonstrate that this particular solution can improve the efficiency of the programs and increase student enrollment and retention levels.

### Current Evaluation with Adult Learners

In preparation for a larger-scale evaluation, pilot testing with five users was conducted for three weeks at the end of the Fall 2009 semester. The participants were adult learners (4 females, 1 male) enrolled in CALS' literacy programs. A typical student attending these classes has completed some years of formal schooling (usually up to the end of middle school) and works full-time in a non-professional position (e.g. cleaning, farming, etc.). They are able to carry out non-complex reading/writing tasks (some newspaper reading, writing a very simple letter, etc). The CALS sessions are usually conducted in an informal setting, resembling one-on-one tutoring. There is no formal evaluation of academic progress. The teachers' role is to facilitate the learning process and to guide students in their quest for self-improvement at the students own pace toward their own individual goals.

During the pilot study, each participant received one ultra-mobile device running ALEX©, to be used both in the classroom as well as in environments outside the classes. Users were encouraged to explore the functionality of ALEX© without any constraints placed on the way the application was to be used. Data

collected from the pilot study is currently being analyzed. Early observations and preliminary analysis of semi-structured interviews with participants have, however, revealed that ALEX© is well received by adult literacy learners. It is perceived to help students in the classroom when working on exercises that involve the use of language resources (e.g. dictionaries, thesauri), as well as with the pronunciation of difficult words (which is an essential component of the literacy programs). It also provides them with assistance when doing homework – one student reported being able to complete twice the regular amount of homework in a week with the assistance of ALEX©. Furthermore, our pilot study has revealed that ALEX© is being used outside prescribed academic activities in an exploratory manner – mainly text reading (such as magazines and even books) and word pronunciation practice.

### **The Road Ahead**

The current literacy levels of working adults do not meet the demands of today's information-centric society. Since, in Canada at least, existing literacy programs only reach a small number of those who would benefit from them [2], there is clearly a need for ground-breaking approaches to adult literacy training. To meet this challenge, we propose a mobile application that enables adults to improve their language skills outside the confines of literacy programs, and bring them closer to functional literacy and independence. The encouraging results of our preliminary study warrant further investigation into the use of mobile language tools to assist low-literacy adults. A large-scale longitudinal study of ALEX© will be carried out in 2010. It will look at determining the effectiveness of ALEX© with respect to literacy skill development and the confidence of target users, and at evaluating the

effectiveness of ALEX© for adult literacy programs. The study will also investigate the implementation of such applications in adult learning programs.

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