EasyAuthor-Supporting Low Computer Proficiency Teachers In The Design of Educational Content for Adult Illiterates

Abstract
It is inevitable to make use of technology to support 287 million adult illiterates of India spread across 22 Indian Languages and dialects. However, even with many advances in end-user software engineering and a multitude of authoring tools, teachers often have to spend considerable effort to design and use technology for developing educational content.

In this paper, we present EasyAuthor, a preliminary environment for end users (i.e., low computer proficiency teachers) to create and manage educational content for adult illiterates in India. The primary intent of EasyAuthor is to support teachers with the easy authoring of educational content and at the same time adhere to adult literacy learning methodologies. We describe the process of authoring educational content using EasyAuthor and the use of ontologies as a backbone. We then briefly discuss a preliminary study of our tool with a few teachers and present some interesting aspects of EasyAuthor along with its limitations. Finally, we conclude with some promising future directions.

Author Keywords
Teacher authoring tools; End-user tools; Computer-Aided Instruction; Adult illiterates; Educational content.

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Figure 1. A worried teacher looking for a simple interface to model educational content.
The Adult Literacy Case Study

Background: Design of technology to support 287 million adult illiterates spread across 22 Indian Languages

Existing Related Work: Tata Consultancy Services (TCS), an Indian Software House has designed a technology to support adult literacy called Computer Based Functional Literacy and made around 1,50,000 people literate [4]. We have used software engineering techniques in the last 6 years and reduced the effort for development from 5 person-years to 5-person months [3]

Challenge: How to design technology such that it is adhering to adult literacy learning methodologies and at the same time easy to author by low computer proficiency teachers?

Our Current Work: We have designed an ontology based educational modeling framework and currently designing a platform to address the challenge

ACM Classification Keywords
H.5.m [Information Interfaces and Presentation]: Miscellaneous – User-centered design, adult literacy

Introduction & Motivation
According to UNESCO, India has a staggering 287 million adult illiterates out of world’s 775 [5]. Use of technology is inevitable in order to address this massive challenge. The National Literacy Mission (NLM) of Government of India has researched and developed a uniform learning methodology called Improved Pace and Content of Learning (IPCL) [6] that is applicable to 22 Indian Languages and dialects. The initial series of technologies to support adult literacy in India have focused on developing digital content for adult literacy [4] and later generations have focused on reducing the effort for development of educational content using software engineering ideas [3]. During this experience of 6 years, we are still left with some open challenges in the context of technology for adult literacy.

- It is difficult for low computer proficiency teachers to create and adapt adult literacy educational content for evolving needs (Figure 1)
- Current technologies for adult literacy do not adhere with adult literacy learning methodologies
- It is effort-intensive to develop and maintain a large scale and variety of educational technologies for adult literacy covering all Indian Languages
- The technologies and tools should be multi-lingual

In this paper, we focus on the first two challenges by designing and developing a tool for low computer proficiency teachers to support easy authoring of adult literacy educational content.

The Tool Users – A Special Audience
There is a huge scare of qualified teachers for adult literacy in India and a teacher (called as prerak) has typically either passed or failed 10th grade and generally do not have computer literacy. However these preraks are given two days of training to use computers to teach if computer aided instruction (CAI) is used to teach adult illiterates. These are the main people who will use our tool to create and manage digital content. Most of these teachers are inexperienced even from teaching viewpoint and hence adult literacy learning methodologies have to be integrated into educational technologies to maintain good quality of instruction.

Design Rationale for EasyAuthor
Considering the adapting needs for technology for adult literacy as well as the background of our end users, there are several design decisions that we have considered during the design of EasyAuthor.

Must adhere to Adult Literacy Learning Methodology
Lack of pedagogic focus is the most common reason attributed to the failure of CAI initiatives and in the case of adult literacy, we must ensure that the educational content that is developed adheres to the uniform adult literacy learning methodology developed by NLM. The core idea of this methodology is that adult learners go through a journey from known to the unknown learning the skills of reading, writing and arithmetic on the way through thematic content and apply their learning to real life scenarios like reading a newspaper, board signs, writing letters and so on.

An Ontology for Adult Literacy Educational Content
Ontologies have been quite useful in education in the recent days mainly for representing and communicating
The design of EasyAuthor uses ontologies as backbone for capturing educational content in the form of data and uses that data in the design of technology for adult literacy. We have designed an ontology based educational modeling framework to capture several aspects like learning goals, teaching process and instructional material. The core aspects of this ontology are Context, Goals, Process, Instructional Material, Role, Evaluation and Environment, each of which is elaborated as part of our framework. Figure 2 shows a part of the teaching process (LearningDesignProcess) that captures a lesson as a play, each play consisting of several acts and each act consisting of several scenes, which are further divided into instructions where actual teaching activities are performed. This is further driven by a reasoning framework that models content in the form of facts, cases, rules, models and theories. EasyAuthor builds on these frameworks as the basis and provides a wizard driven interface for supporting teachers to create educational content. In case of adult literacy, we use David Merrill’s principles for teaching process and Bloom’s Taxonomy for learning goals.

Variabilities in Adult Literacy Educational Content
Visual and audio elements are the two main aspects that have to be changed at the raw level in the design of technology for adult literacy. It might seem quite simple to do these changes but considering the background of teachers for adult literacy, even these simple changes are effort intensive and are often confusing. There are nearly 20,000 visual and 2,500 sound elements in a typical e-learning system for adult literacy and it is not easy for a teacher to change particular elements unless the entire content is systematically organized and intuitive user interfaces are provided for the teachers to change them. It is here we believe that EasyAuthor tool helps these teachers to easily create and change the educational content. We do not consider several other aspects like user interface, learning goals and so on which are also amenable to change as these are complex for our users to deal with unless given rigorous training. To this end, several parts of the adult literacy educational content come pre-fabricated with EasyAuthor and a teacher who wishes to change the options can always configure the tool and customize the e-learning system.

Technology Decisions
Automation and semi-automation of educational technologies requires some pre-fabricated decisions to be made. As we separate the different aspects of adult literacy educational content as ontologies and data, we hope to easily change the technology with less effort. Researchers have developed ontology-driven user interfaces to capture domain knowledge and generate interfaces. EasyAuthor relies on this existing work for developing the tool but currently does not automatically map from ontologies to user interface elements.

EasyAuthor – A Prototype
First and foremost, EasyAuthor is a specifically designed tool for low computer proficiency teachers based on ontologies. This preliminary version mainly focuses on adhering to adult literacy learning methodology rather than on user interface. Figure 3 shows a high level process of creating adult literacy educational content using EasyAuthor. The teachers will follow task oriented wizards selecting the options in a step-wise fashion and then configure and create the content as per the given instructions. We briefly explain the three key steps in the authoring process as follows:
Figure 3. A high level process for authoring adult literacy educational content using EasyAuthor, Screenshots of the tools are shown on the left.

(i) Gather Educational Content for Technology
This is a manual step where the teacher has to gather all the physical content available from NLM and other sources. For e.g. instructional material and guidelines to teach adult illiterates are available from NLM.

(ii) Preparing the Configuration Based on Ontologies
Here teachers have to convert the physical content into digital content aligning with ontologies and frameworks in [2] to achieve the goals of EasyAuthor. In this step, the teacher has options to choose the learning methodology, create learning goals, decide the learning design process and instructional material to be used for the specific adult literacy e-learning system (ALeS).

(iii) Preparing the Content Based on Ontologies
Here, the teachers can go through a series of wizards and follow the guidelines for filling the content of ALeS.

Figure 4 shows a screenshot of EasyAuthor showing some activities of an initial start-up wizard for creating learning goals. The teacher is given some guidelines and instructions for creating ALeS using EasyAuthor. After gathering the information, the first step is to select the configuration that the teacher wants for the specific system and specify learning methodology, goals, context and so on. Most of them are pre-fabricated in EasyAuthor and the teacher can change if he/she desires. Figure 5 shows a screenshot of creating learning goals using Hindi language user interface.

One major difficulty in designing EasyAuthor was to balance between pre-fabrication of content and providing flexibility to teachers. We expect further technical glitches in terms of implementing EasyAuthor for other platforms like web, tablets and mobile.
The steps in the wizard help the teacher to fill all the required content for creating an ALeS.

The teacher selects the appropriate step in the learning design process and creates content at this specific level.

All the data captured using this wizard is based on detailed ontologies that ensure mapping with adult literacy learning methodologies.

The goals are specified using Bloom’s Taxonomy.

Figure 4. Capturing learning goals using EasyAuthor.

**Related Work**

The work presented in this paper spawns several areas ranging from end user authoring tools to learning content automation tools. Teachers often find it difficult to create and use technology for teaching because of disconnect with pedagogy and massive effort [2]. A recent survey in end user software engineering reveals that several professionals including teachers develop software in their daily life [9]. A multitude of content authoring tools have emerged in the learning domain for a wide range of end users [1]. However, there are few tools like Cloze [7] where low computer proficient users (like teachers) create digital content. Researchers have designed novel interfaces for semi-illiterates [8] [10]. However these tools are for users and not for people who want to develop digital content like teachers, which is our case. There are several tools for teachers to easily create content for specific audience while teaching English as Second Language. Tools for ontology based learning content generation are designed for ontology designers and content developers and not for end users like teachers. To summarize, there is sparse research on authoring tools for adult literacy, which is the focus of EasyAuthor.
Formative Evaluation & Future Plans
While we did not do a formal evaluation of EasyAuthor, we have discussed and interviewed adult literacy teachers during our earlier field studies to find out the needs of preraks. In our preliminary study with four adult literacy teachers, we found an initial confusion with respect to the terminology in the user interface of EasyAuthor but after using it few times, the teachers are able to create adult literacy educational content for a lesson with less effort. In future, we plan to evaluate (i) user interface from teachers’ view (like effort, quality of content, technical and learning barriers of authoring tools) (ii) effects of learning (like knowledge, skills) through content created using EasyAuthor. We further plan to conduct pilot studies and measure the above factors with and without EasyAuthor.

Conclusions & Future Work
The core contribution of this paper is to show that an authoring tool can be built for special kinds of users like low computer proficiency teachers in the domain of adult literacy. We have made certain decisions that affected the design of EasyAuthor, mainly to adhere to adult literacy learning methodology, which is critical. A major future research direction is to study the technical and learning barriers for low computer proficiency teachers during the usage of EasyAuthor and finding ways to address these barriers. We are currently doing a revision of EasyAuthor improving its user interface and believe that this work lays a strong foundation for creating a family of end user tools for easing and automating the development of educational content.

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References