Towards an English Reading Intelligent Tutor System for Native Spanish-Speaking Undergraduate Students

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Abstract. Intelligent Tutor Systems (ITS) are challenging in domains as reading and writing, and target users require specific material to mature reading abilities. We are developing a methodology to produce reading ITS for undergraduate students, facing decisions in both fields, educational and computational; the contribution is to provide suitable material of interest to each user among available material.

Keywords: Intelligent tutoring systems, reading comprehensions, readability metrics.

1 Motivation

Reading is essential for school and life. In the international standard test PISA, Mexico is statistically significantly below average scores [1], undergraduate students do not perform better. Reading in a foreign language adds challenges to the task. Educational technologies may be helpful out of the classroom to improve students' skills. Advantages include following a personalized path, working without teachers' time constraints, spending more time on topics of interest or need reinforcement. Intelligent Tutoring Systems (ITS) have proved helpful for many disciplines, mainly in well-defined domains such as mathematics where there is only one possible answer, ill-defined domains like reading and writing are still challenging [2].

2 Previous Work in the Area

Reading ITS are scarce. They are based on their own corpus and targeted for specific users as the material is different for each. iSTART [3] is the closest to our project as it was developed for high school and college students. CAERS [4], ITSS [5], and EMBRACE [6] were developed for children. AutoTutor [7] and iSTART-All [8] for low literacy adults. Further information on art state refers to [9]. Only AutoTutor allows the user some freedom on the material to use.

Related advances that could be included in a reading ITS are text simplification [10], automatic readability metrics, overlapped clustering [11], question generation [12],

question classification [13], automatic essay evaluation [14], interpretable semantic similarities [15], among others.

3   Research Objectives

If the actual development of Natural Language Processing is enough, it is possible to follow a methodology to create reading ITS for English as Second Language (ESL) undergraduate students. The objective of the work is "To design and evaluate a methodology to develop an ITS for reading in English as Second Language for Spanish-Speaking undergraduate students". Specific objectives are:

- Gather reading material in English and classify them to conform domain module.
- Integrate activities pre and post-reading to develop reading comprehension abilities.
- Create a model and build an ITS prototype.
- Validate the ITS among ESL expert teachers.

4   Methodology

Every ITS requires enough material to provide to the student. Natural language processing requires corpus, a group of texts. Corpora are expensive to create in time and effort as it is manually reviewed or tagged.

The first step requires identifying text complexity, by language level or by the obtention of Flesh-Kinkaid and RDL2 readability metrics on every text in the corpus. Previous works have empirically proven that RDL2 is useful in second language learners' reading tasks.

The second phase, to recommend texts to readers, requires obtaining documents similarity. The algorithm should provide at least one similar document to the last read by the user and some others very different from it. As there are no right or wrong suggestions, the idea is to form clusters to represent groups of topics of interest. From those, the algorithm will suggest texts for the user's reading level.

The third phase needs performance evaluation, which is a vast area in reading comprehension. Three main methods consist of questions, writing, and diagram development. The first one is popular among second language learners; the second option is more common in monolingual students as it requires additional mind processes to produce text. The third option is used to facilitate information visualization mainly for young readers. All types of evaluation must be automatic in the ITS. First experiments are intended to include human elaborated questions attached to texts.

User experiments will include students with access to the system and a control group without the system. From the experiment, we will observe the performance of both groups in the reading comprehension assessments and apply a survey on interest. The idea is to provide at least five sessions to both groups and gather information related to reading performance in Spanish and English.

Among tools considered, Coh-Metrix for metrics and other text scores. Natural Language Toolkit NLTK [16] and Stanza [17]. Python as the programming language.

5 State of the Research

First, a small expert group was created, and the four members are teachers experienced in English reading comprehension from different Mexican universities. Second, a survey was developed to register English teachers' experience in classrooms about reading. Their observations allowed us to set goals on comprehension, user freedom, and strategies.

Tutor architecture was adopted from [18], defining domain, tutor, student, and interface modules. Also, some ideas from English websites were collected to design a scalable navigation map.

The first module to create is the domain, as it contains the materials. We started creating a corpus from pages for English Second Language readers, but we have not collected enough material targeted for adults with creative commons license and reading comprehension questions. While that corpus grows, we are working with the OneStopEnglish corpus [19]. The corpus allows three manually simplified versions of each text and provides POS tags and common readability metrics, but it has no questions.

Some fast tests indicated that reading levels are not aligned with CEFR. Additional text analysis was performed with Coh-Metrix to obtain readability metrics for each text. Results show a brief comparison among them, clarifying the deepness of information used to obtain them. This analysis included the tool used to rank text in CEFR levels.

We have already started the first experiments to create topic groups, and we are adjusting parameters. In parallel, a basic recommendation system was constructed using cosine similarity. A pilot exercise is desired soon to obtain users' opinions and suggestions.

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