TEACHER DASHBOARD: AN EXPLORATORY ANALYSIS ON LEARNING WITH PERSONALIZED LANGUAGE TEXTBOOKS

CARLOS HUMBERTO PAZ RODRIGUEZ
Msc. in Computer Science

Learning analytics

Department of Computer Science
Faculty of Science and Engineering

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ABSTRACT

Intelligent tutoring systems give personalized and dynamic content for students. One application is custom textbooks for learning foreign languages. Teachers need accurate monitoring metrics that allow them to measure the performance of their students in order to evaluate their progress. An interactive dashboard with Key Performance Indicators is designed and implemented to enable teachers have real time monitoring of the class.

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Part I

BACKGROUND

1 INTRODUCTION

1.1 INTRODUCTION

ITS (Intelligent tutoring systems) are applications that provide a user whose learning a topic, with adaptive capabilities that evaluate the progress of his learning process and provide custom feedback that helps the student focus on his opportunity areas. ITS are also used by teachers who monitor the students' progress and help them provide timely and personalized feedback to the students during their learning process. [7], [13] and [3] have used data mining algorithms to extract relevant patterns in the learning process. Ranging from normal statistical visualizations [13] to complex multidimensional visualization [3], different approaches to provide understandable insight into the learning process have been researched. Verbert et al.[16] has performed a comprehensive comparison of different analytical dashboard for ITS systems. Gamification [6] has also been proposed as a way to tackle lack of interest due to monotony in the learning experience.

1.2 RESEARCH QUESTIONS

With the dynamic capabilities of the Web, a personalized textbook for learning foreign languages [8] is an ongoing research project. The tool allows users to read and learn new vocabulary by recommending texts of their own interest. A pilot test was implemented in a classroom and both students and professors showed an interest in using a tool like the one proposed. One of the outcomes from this research was that professors wanted to have monitoring functionalities that would allow them to keep track of their students' work and progress. Therefore an interactive dashboard with a set of relevant metrics was implemented. The two main research questions that get answered are:

1. As a user of the Zeeguu System I want to see my learning progress in the system.
2. As a teacher I want to see my students' usage of the system, as well as the amount and quality of work.

1.3 SIGNIFICANCE OF RESEARCH

Personalized textbook project [8] proved to be an auxiliary tool in the learning process by providing dynamic learning material and exercises according to the level of knowledge and the interests of the student. However, for the teacher it is difficult to evaluate the progress done by the students, so they need to ask for a written report about

the work performed, which is not optimal nor trustworthy source of information. By enabling the teachers to monitor in real time the work done by their students and the difficulties they are having, teachers are given additional tools so that they can personalized teaching assistance according to the students' needs. Furthermore, with the continuous appearance of learning platforms and accessibility to dynamic content, it is certain that in the following years, new teaching methods that use technologies like this will emerge. These metrics will be extensible to other learnings platforms and topics.

2 LEARNING ANALYTICS

Learning Analytics is the research area focused on collecting, analyzing and visualizing information [2] related to the learning activities within a learning platform. Most of the current research focuses on Learning Management Systems (LMS) such as Moodle (https://moodle.org/) [10] [13] or Blackboard (https://www.blackboard.com) [1]. The existing research therefore focuses on systems that emulate a virtual university, which collects data about students, courses enrollments, assignments, exams and grades.

LEARNING MANAGEMENT SYSTEM Is the application that enables and manages all the educational content. Typically it also controls courses registration and tracks data about the students' progress. Finally it provides reports based on the collected data [17].

The nature of Personalized Textbooks implies that the learning road is different for each student, therefore the information collected for one student might be very different from the rest (because of his subscriptions, the language being learned, the current level of knowledge, etc), making it more difficult to compare his learning performance against other students. Additionally, the level of granularity is more specific, both because is focused on a specific topic and language, and because the type of analysis goes into a deeper level of detail (i. e.activity tracking each individual reading or practice session).

In short, a new method for collecting and analyzing data is proposed.

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DASHBOARDS

The term "dashboard" has evolved over time, the latest definition refers to a visualization of the most important information in order to achieve a particular goal, and within the visual space of a computer screen [10].

The main goal of a dashboard is to provide timely and useful information so that an decision can be made consequently. Verbert et al. describe the mental process that an user of a dashboard performs to make sense out of it. He states that a good dashboard should first help users acquire self-awareness by looking at data about their past activity and their current state in the learning process. Second, it invites to do a personal reflection. So that these questions get answered by exploring the visualizations and finally it must produce a change of behavior based on newly set goals. Telea describes the visualization design pipeline as an iterative process where the goal is to narrow the scope of the problem until a clear question can be answered with a visual tool. The visualization has to be designed for a specific user in mind, taking into account the complexity for interpreting the visualization and the level of precision when decoding the information back into abstract data.

A good quality dashboard should provide all the relevant information in a summarized way to enable the user solve a particular problem. Two set of principles were developed to evaluate dashboards design.

- SMART (synergetic, monitor KPIs, accurate, responsive, and timely)
- IMPACT (interactive, more data history, personalized, analytical, collaborative, and traceability) [9]

When creating a new dashboard, the most relevant information should be located at the center so that it stands out, and with the remaining space around the central visualization, it should provide details that support the answers obtained with the central element.

4 ACTIVITY TRACKING

The term activity tracking has recently emerged and is mostly related to wearable devices that monitor fitness data [19]. In a more abstract sense, activity tracking is the process of collecting user's information over time for a specific topic.

In the web context, technologies such as Javascript listeners and external tools such as Google analytics are combined to better detect when a user leaves a page. However it is impossible to track when a user closes the browser even for state of the art technologies, therefore Google analytics uses a configurable timeout parameter to close the activity session [11].

In a slightly different context, wearable devices [5] are not infallible under every external condition, and activity tracking can only be precise while collecting multiple measures and obtaining the average value [4].

Santos, Verbert, and Duval studied the effect of time tracking on the learning process. They concluded that time seems to be a good indicator of the learning progress of a student. During their experiments they used different tracking tools, from manual (E. g.Toggl) to automated (E. g.RescueTime) software applications were tested. An advantage of manual tracking is that the student is more aware of his habits, therefore the commitment with the learning is strengthened, but the problem is that the students can declare false information, making it difficult for the teachers to detect problems and provide effective support. For automated time tracking Santos, Verbert, and Duval used RescueTime (`https://www.rescuetime.com/`), this tool tracks time spent on each application. For our project, we are interested in accurately detecting reading time. Manual tools require user input, our customers are high school language teachers who want to avoid students easily lying about their work. On the other hand, automated tools such as RescueTime, cannot really track text reading time, because a student can easily open an article, walk away and come back 1 hour later and pretend that they worked for 1 hour, while in reality they did not read at all. The most precise way of measuring reading activity is by implementing eye tracking solutions, which would result both expensive and invasive, and even though, it cannot detect if the user is really paying attention and learning or only staring at the text. Other language learning systems such as Duolingo (`https://www.duolingo.com/`), only provide information about correct or incorrect exercises but no information about the time spent on the application, or time invested learning a foreign language. In chapter 6, a detailed description of our approach for tracing reading sessions is provided.

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WORD KNOWLEDGE

According to a study done by Webb, orthography, grammatical function and syntax knowledge of a word can be greatly benefited by learning words in context. And the more repetitions of finding a word in different texts improve the vocabulary knowledge of foreign language students. Qian makes a distinction between word knowledge breadth (number of known words) and depth (different meanings of the word knowledge). He mentions that in order to better comprehend texts in a foreign language is important not only to memorize a single translation of a word, but to learn it in different contexts so that different meanings of the word are learned.

Part II

RESEARCH METHODOLOGY

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IMPLEMENTATION

During the results of the pilot test, students and professors gave feedback on their impressions of the system, therefore these feedback will be used as a starting point for designing a new visualization interface. The teachers will be contacted again because they know already the system and have experience in teaching with modern systems, so they will be a key evaluation factor for the project's success. Existing research approaches will be used as starting point reference and their applicability for the particular problem of foreign language learning will be evaluated. Modern visualization design principles will be especially considered during the whole design process.

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INTERVIEWS

8

SESSION TRACKING

9

WORD INTERACTION TRACKING

10

DASHBOARD

Part III

RESULTS

Part IV

DISCUSSION

11

DISCUSSION

12

FUTURE WORK

It will be tested with the next semester teachers and students

Reading speed (also for filtering reading articles estimated reading time)

Move to prescriptive analytics

Part V

APPENDIX

A

INTERVIEW A

B

INTERVIEW B

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DECLARATION

Put your declaration here.

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Carlos Humberto Paz
Rodriguez