The use of Web technologies is becoming an increasingly relevant and valuable asset for children education [Kni14], both because it enhances the class environment and introduces children, from early stages of their lives, into today's information society [S10]. K-12[[1]](#footnote-1) students use the internet on a daily basis to locate materials that can help them with different academic tasks, from finding information for a class presentation to discovering the meaning of a new word. For this purpose, they often turn to search engines as the initial portal that will lead to the retrieval of materials to satisfy their information needs, including news articles, books, or term definitions [Kni14]. As described in [Dan13], incorporating technology with more traditional activities into early childhood education is not a trivial task. Use of technology in classroom (and outside of it) for learning tasks is very common nowadays. However, the survey conducted in [Bil13] showcases that from of 300 retrieved results when using popular search engines, only 1 was at a standard reading level for 7th graders, which is an important issue since it is hard for children to process and comprehend text whose readability does not match their reading levels. For making search engines more tailored towards young users, two conditions should take place: (1) the search engine needs to be able to understand children's information needs, and (2) the retrieved resources need to be adequate for the child in terms of understanding their content.

The first condition is hardly met by popular search engines, given that they are designed to satisfy interests and information needs of a general audience, without any specialization for niche users [S11], such as K-12 students. This usually leads search engines to wrongly capture the intent of a query written by a child, either because of the use of a long, natural language query of which the search engine can poorly detect the main content, or because a one-word query was ambiguous and the search engine gave preference the results not suitable for young users [Bil13].

Furthermore, even when children retrieve resources relevant their information needs, it is not certain that they will be able to comprehend them because of difficulties in interpretation of retrieved results [Bil13]. “*Web users differ widely in their reading proficiency and ability to understand vocabulary, depending on factors such as age, educational background, and topic interest or expertise. These facts currently impair the ability of users to carry out successful searches by finding material at an appropriate level of reading difficulty for them If conducted correctly, information discovery tasks can lead to more than just finding a facts to answer the question proposed by the teacher*” [Col11]. K-12 students belong to the category of users with varied reading abilities, a fact usually overlooked by popular search engines which do not personalize retrieved results based on this characteristics [Col11]. As a result, students can often get discouraged when they try to read retrieved contents that are outside their comprehension levels, whether being too easy or too difficult for them to understand. Therefore, providing K-12 students with filtering tools they can use to seek for adequate resources they can actually understand is imperative since reading is an important skill in the academic environment, a competence that can be critical for students' educational opportunities and their careers [P41]. As reported by Lennon and Burdick [P32], reading for learning takes place when the reader comprehends 75% of a text. This represents an appropriate balance that allows the reader to positively understand the text, while also finding challenges in the reading process that will motivate him to improve his skills [P32]. Therefore, unless the retrieved resources match the reading skills of the respective users, reading for learning, and learning as final goal, as a part of the online information seeking process cannot take place.

As a response to issues related to information seeking process through search engines, we discuss our ongoing efforts to develop a web search environment designed to help both students and instructors in the process of finding adequate online materials. ***Y****ou****U****nderstood.****m****e* (*YUm*) aims is to improve search engines, so that they can be used as a tool to facilitate learning, rather than just retrieving information, within the K-12 academic environment. The main goal of *YUm* is to enhance the information seeking process and increase children’s comprehension of retrieved materials by combining diverse functionality oriented to overcome search engines deficiencies when dealing with children. YUm also provides the student with a personal account which keeps track of the current readability level together with a feedback given by students on previously retrieved results materials, e.g. if it was too easy, too hard, or of satisfying difficulty. This enables *Yum* to make predictions regarding the future reading abilities of each student, which is incorporated in order to speed-up the process of identifying adequate materials by both students. Besides students, educators also benefit from *Yum*, since they have access to the information related to current reading capabilities of each student and their change in time, which allows them to enhance the learning process. *YUm* makes the information retrieval process effective and efficient by taking advantage of readability formulas, a search engine, a search intent module [SIGIR16], and query recommendation tool [RecSys16].

The novelty of *YUm* lays in the enhancement of search engines in general to create an environment which not only serves the student retrieve information relevant to their discovering tasks, but also ensures that the information retrieved will be understandable by the student. *YUm* ties literacy of children with information discovery tasks employed in the school. To the best of our knowledge, the proposed environment is the first one that tackles the issue of reading resource retrieval as a whole. Starting from the assessment of an individual students' reading abilities and ending with the retrieval of adequate materials, all features and functionalities within *YUm* work in cooperation to improve the way in which online resources are located. Furthermore, the presented environment does not only filter documents retrieved by a search engine, but it can also be applied on local resources, such schools' library catalogs, and thus become easily customized to specific educational programs. As described by Collins et al. in [Col11], users' reading proficiency is estimated based on both, current and past searching process. Based on that, one of the important contributions of this work is that *YUm* builds a bridge to establishing a direct relationship between teachers and students, where teachers can follow the changes in readability levels among the students and further foster the learning process.

Besides describing the initial design, in this paper we discuss the findings of the analysis conducted to compare *YUm* to popular search engines and identify the need for such an environment. In addition, we recognize need for further enhancements of the proposed environment and problems to be considered in the future.

Related Work

@article{Kni14,

title={Finding knowledge--what is it to ‘know’when we search?},

author={Knight, Simon},

year={2014},

publisher={Institute of Network Cultures}

}

1. K-12 refers to the publicly-supported school grades prior to college in the education systems from the United States of America, Canada and other countries. [↑](#footnote-ref-1)