RESEARCH PAPERS

A NEED FOR AN ADAPTIVE SEARCH TOOL FOR TEACHERS: CASE STUDY

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ABSTRACT

Whether intentionally or not, teachers are excluded from having the full benefit of the new technologies developed and adapted by the search engine developers, while all the current and proposed research and developments are focused mainly on the end users (students/learners, businesses and/ the government) and not specifically on teachers who act as the mediator between information and their students. Consequently teachers are left searching in isolation, without the assistance and guidance of the adaptive search engines.

Therefore, in connection with iClass project an adaptive search tool called the "Teachers Search Tool" has been proposed. The "Teachers Search Tool" will be aimed at addressing some of the main problems faced by teachers when preparing their teaching materials like when searching online for "Cross Curricula", "Differentiated" and "Project-based Learning" materials.

Keywords: Hypermedia, Adaptive hypermedia, Adaptive Presentation, Adaptive Navigational Support, Adaptive

1.1 INTRODUCTION (Information Overload)

In today's world of information, we as individuals have to overcome one of the most time-consuming problems of searching, which is called 'the information overload'. Individual users' expectation from system developers is to be able to locate their desired information from the great search engines like Google and Yahoo and be satisfied and appreciative with their search results. However, users, especially teachers, are faced with great difficulties when searching online via the search engines. Moreover, the task of searching and locating materials/objects online is becoming more and more difficult and time consuming especially when "7 million pages are added on each day to the Internet, 8 billion emails traded each day in the U.S. and Europe only, and the volume of information stored in corporate Intranets, file systems and document management systems are growing faster than ever" (Renaud Laplanche, 2005).

The most obvious answer is 'personalisation'. Search engines need to allow their users to personalise their searches by adapting to their individual users' needs and preferences. As a result "search engines have evolved through several generations since their inception, progressing from simple term matching to link analysis techniques (such as IBM's Clever Project and Google) and relevance feedback. Furthermore, search engines have now entered their third generation, and current research efforts continue to be aimed at increasing coverage and relevance" (Renaud Laplanche, 2005).

1.1.2 Teachers' information overload

Whether intentionally or not, teachers are excluded from having the full benefit of the new technologies developed and adapted by the search engine developers, while all the current and proposed research and developments are focused mainly at the end users (students/learners, businesses and/the governments) and not specifically on teachers who act as the mediator between information and their students. Consequently teachers are left searching in isolation without the assistance and guidance of the search engines.

1.2 THE CHALLENGE: What do Learners & Teachers need?

We know that to facilitate and enhance learning, both learners and teachers need to have learning materials which are adapted to their individual needs, purposes,

context, abilities, disabilities, and language, with regards to content, presentation, examples, trials, curriculum, syllabus, levels, learning styles, navigation and so forth. At present we have hypermedia and adaptive hypermedia systems aimed at satisfying these needs.

1.3 HYPERMEDIA (1st Solution)

As was explained by Conklin "Hypermedia is a style of building systems for organising, structuring and accessing information around a network of multimedia nodes connected together by links" (Conklin J, 1987). There are two generations of hypermedia systems (Halasz F, 1988). "The first generation included systems such as Xanadu, ZOG, NLS/Augment, Hypertext Editing System, FRESS, Dynabook. They were mainframe-based text-only hypertext systems. They had support for multiple users sharing the hypermedia information network. The main characteristic of first generation systems is their target task domain and scope. They had been proposed as the mechanism for storing and retrieving the whole world's literacy, as a natural mechanism for reflecting the mind, as an augmentation environment for supporting users, as a replacement of traditional text writing and reading. They were primarily for authoring purposes and therefore, navigational aid capabilities were limited. They did not provide any particular mechanism to extent the environment or to customise it to a particular user's needs. Nodes were untyped, without supporting composites. Links were single direction, single destination. The only structure supported beyond graphs was hierarchical structure. Graphical browsers were non-existent and concepts like guided tours or metaphors were not used. Search mechanism was limited to simple string search. The user interface was based on simple text monitors and it was frame based" (Salampasis).

The second generation of Hypermedia were designed to "support graphics or animation nodes and they had more advanced user interfaces" i.e. Notecards, Neptune, Intermedia, KMS, Writing Environment, Emacs/INFO, and Document Examiner (Salampasis). Compared to the first generation systems, "second generation systems are designed to support one user or a small group of users"(Salampasis).

1.3.1 The Problem with Hypermedia

While hypermedia has become more popular and hypermedia systems come into more widespread use, limitations and shortcomings of current hypermedia are becoming increasingly apparent (Halasz F, 1988). The simple basic hypermedia model is not rich enough to support the organising, structuring and accessing tasks required by many applications (Hammond, 1993). Problems like user Disorientation (getting lost or disoriented occurs when a user does not know where he is and where to go next), development of user Cognitive Overhead. From the above we can conclude that hypermedia systems place more responsibility on the user for accessing, sequencing and deriving meaning from the information which a hypermedia system carry" (Salampasis).

Therefore, Hypermedia is NOT adaptable to the individual goals, interest and knowledge, and as a result, the learners' and teachers' needs are not fulfilled.

1.4 ADAPTIVE HYPERMEDIA SYSTEMS (2nd Solution)

Adaptive hypermedia (AH) is an alternative to the traditional "one-size-fits-all" approach in the development of hypermedia systems. Adaptive hypermedia systems (AHS) build a model of the goals, preferences and knowledge of each individual user, and use this model throughout the interaction with the user, in order to adapt to the needs of that user (P. Brusilovsky, 1996). For example, a student in an adaptive educational hypermedia system will be given a presentation that is adapted specifically to his or her knowledge of the subject (De Bra, 1998), and with a suggested set of most relevant links to proceed further (P. Brusilovsky, Eklund, J., & Schwarz, E., 1998b). An adaptive electronic encyclopedia will personalize the content of an article to augment the user's existing knowledge and interests (Milosavljevic, 1997). A virtual museum will adapt

the presentation of every visited object to the user's individual path through the museum (Oberlander, 1998)"(P. Brusilovsky, 2003). Furthermore, "AH systems can support users in their navigation by limiting browsing space, suggesting most relevant links to follow, or providing adaptive comments to visible links. It is quite natural that educational hypermedia was one of the first application areas for AH. In educational context, users with learning goals and knowledge on the subjects require essentially different treatment. It is also in educational hypermedia where the problem of "being lost in hyperspace" is especially critical" (Atif, 2003).

Brusilovsky (P. Brusilovsky, 1996b) distinguishes between two types of adaptations that are applied by AH systems: Adaptive Presentation, and Adaptive Navigation Support.

1.4.1 Adaptive Presentation

"The goal of adaptive presentation techniques is to adapt the content of a page according to the knowledge, goals and other characteristics of the user. Adaptive presentation is mainly used to reduce the information overload within hypertext pages, eliminate scrolling and subsequently, relax the problems of "lostness" and cognitive overload.

The most popular method of content adaptation is hiding from the user part of the information that is not relevant to the user's knowledge or interests. The main disadvantage of hiding or altering information in the page's content is that users are deprived from information that might be useful as adaptation algorithms cannot perfectly determine the exact needs of users. A technique that addresses this problem is stretch text. Stretch text is a kind of hypertext where text can be collapsed or expanded by clicking on 'hot words' " (Tsandilas, 2003).

1.4.2 Adaptive Navigational Support

"There are a number of different methods and techniques that are used in adaptive educational hypermedia (P. Brusilovsky, Eklund, J., and Schwarz, E, 1997; P. Brusilovsky, Schwarz, E., & Weber, G., 1996c). Among others, a group of

techniques known as adaptive navigational support has become especially popular in adaptive educational hypermedia. Adaptive navigational support technologies have been evaluated in several application areas and have adapted the behaviour of hypertext and hypermedia systems to individual users. A number of teams have addressed the problems related to navigation in hypermedia such as the problem of inefficient navigation or the problem of being lost that had been discovered when the field of hypertext reached relative maturity at the end of the 1980's (Hammond, 1989). Within a few years, a number of navigational support technologies were proposed (Böcker, 1990; P. Brusilovsky, Pesin, L., & Zyryanov, M., 1993; De La Passardière, 1992; Kaplan, 1993). "While the proposed technologies were relatively different, they shared the same core idea: adapted the presentation of links located on a hypertext page (hypernode), to the goals, knowledge, and preferences of the individual user. The adaptive navigational support technologies introduced by early adaptive hypermedia systems were later classified as direct guidance, sorting, hiding, and annotation" (P. Brusilovsky, 1996b; Peter Brusilovsky, 2004).

1.4.3 The Problem with Adaptive Hypermedia systems

The idea of adaptive navigational support techniques is to help users to find their paths in hyperspace by adapting link presentation to the goals, knowledge, and other characteristics of an individual user. Moreover, adaptive navigation support can guide the students both directly and indirectly and can work with much larger amount of learning material using much simpler student models. In a WWW context where hypermedia is a basic organizational paradigm, adaptive navigation support can be used naturally and efficiently" (P. a. S. Brusilovsky, E., 2001). However, this can only

support the learner's need and NOT the teacher's needs. This is because the adaptive system needs to be adapted to both the teachers and his/her students in terms of their needs, goals and level of knowledge.

1.5 TEACHER'S SEARCH TOOL (A third way)

Teachers are constantly searching for a better way of teaching, which would motivate and enhance their students' learning. One way of doing this is by looking for other relevant media (objects) on the WWW to engage their students, i.e. video clips, animated clip arts, and pictures. However, the Adaptive Navigational Support in Educational Hypermedia can only take teachers half way through this search since the system will only store information about one individual user. It is therefore, designed to treat the user, in this case the teacher, as the sole end-user. As a result, the system is unable to aid the teacher when he/she is searching for objects aimed at teaching a specific group of students, who will have different learning needs and requirements in comparison to the individual teacher.

Therefore, an empirical research was carried out in order to identify what teachers really need from an adaptive search engine in terms of the extra functionalities needed by an individual teacher to accomplish a personalised search. This is not to replace the existing search engines but it is to acknowledge the fact that teachers are most likely to search for their teaching materials online via the available search engines as part of their daily routine work. Therefore, there is an urgent need to identify and build extra features for search engines in order to support teachers' online searching and as was said by the Science-fiction author William Gibson "The future is already here. It's just not very evenly distributed" (Claburn, 2005).

1.5.1 Preliminary Research

To investigate and identify the essential requirements needed by teachers for the adaptive search tool we have interviewed three teachers in UK at both primary and secondary level. The four teachers were selected for interview as they were the most recent winners of the National Teachers Award for their categories (Philip Beadle "Secondary Teacher of the Year", Sue Seafield "Lifetime Achievement Award", Dr

Baldev Singh "Innovation in Teaching Award" and Ms Pam Robertson "Primary Teacher of the Year") and they are considered to be implementing some of the best practice in teaching by their peers.

From the interviews mentioned above, we have learned that teachers are very much in need of a search tool, which would allow them to search for "Cross Curricula materials", "Differentiated materials" and "Project-based Learning materials" that could facilitate their search efforts.

This section will discuss about each one of these items in details with regards to their implications and difficulties faced by teachers when using the current search engines and are used as possible features required by teachers when designing an adaptive search tool.

Cross Curricula

The government in the UK encourages and supports "Cross Curricula" teaching in the Primary Sector. This is where one topic is selected and used as a guideline to plan and prepare individual lesson plans across the whole national curriculum, with the aim of achieving the national standards, set by the government.

Therefore, primary teachers need to comply with the "Cross Curricula" specifications, in terms of both designing and/collecting cross curricula materials to teach in their classrooms.

"The government are saying to us come away from the syllabus which I am very delighted with. We are now moving on to TOPIC work, which I started teaching. Therefore we are working on cross c u r r i c u l a " .
Ms Sue Seafield

"Cross Curricula" encourages students to draw on a wide range of information and subject, they excel in more and offer more input. It allows links to be made."

Ms Pam Roberts

To fulfil these needs, primary teachers tend to search the Internet as their first choice of resource. However, due to the fact that there is a lack of "Cross Curricula" materials online, teachers are left with the huge task of identifying and organising materials. For example, on the topic of the World War II, primary teachers would have to conduct a thorough search on the subject of World War II, which would then need to be carefully reorganised and modified to support other relevant subjects such as Maths, English, Science, Music, P.E., History, Geography and D.T. (design & Technology)

"We usually use the Internet to go and look up the information we want. So we access the Internet through whiteboards (we've got 16 and that includes the nursery). We have programs for literacy and numeracy. What I don't think any one has come up with is basically CROSS CURRICULA work, using the computer <online search> to really support cross curricula work and developing programs which would have everything in it. So if you were doing a topic on History, it would say, here is your history project. Moreover, it would say, here is your geography, that would be the literacy you can get from it, and this is the numeracy, science and the art < in other words it will give you> all the things you can do with that topic, these are cross curricula, no one has done that. **" Ms Sue Seafield, primary headmistress**

Differentiated Materials

Secondary teachers tend to adapt to their students' needs by referring to their "Baseline-data". The baseline data is designed to include information about individual students in terms of their Background (ethnicity, gender, first language and so forth), Ability: i.e. individual Capabilities (SATS Score) and whether the student is "Talented" (this means that they display special attitude in either art, drama, PE and music) and or "Gifted" (this is when a student has superior intellectual abilities, together with other information such as the students' level of education (main

scale or special educational need or whether English is considered to be their second language).

From Mr Beadle's interview, we have learnt that teachers tend to use popular search engines i.e. Google search image to find visual stimuli to show their students which is considered to be a reasonably good search engine/resource as it allows the individual teacher to have the "chaos factor of being a teacher", (that is being able to find other relevant and useful materials which was not originally planned by the teacher but was a result of pure chance).

However, teachers do not treat search engines as their main resource repository since it cannot offer differentiated materials. The ideal adaptive search was defined as one, which supports and provides differentiated materials to teachers.

"If you could make a piece of software which would automatically produce differentiated materials in a subject, then you've got a real winner. Say I have a student who is at the early stages of literacy and I am teaching a lesson on one subject. So if I put <type> in the subject <in the search engine> it would produce me differentiated materials for students who can't read and write English (by proving the teacher with easier worksheets) so that they could actually be involved in the lesson. Then that would be a real winner. So it will produce easy work words, closed procedures, something that they would be happy to create. **" Mr Beadle, secondary teacher**

Project-based Learning

Furthermore, project-based learning is considered to be the best way of achieving personalisation/assessment at both the primary and perhaps more at secondary level.

"If I design a system, one of the best ways I think personalisation can happen or assessment can happen is through project based learning, that's for teachers now and really for the next ten years. You will see that e-learning at the moment is very disjointed. There is no integrated project, which will meet in each curriculum area, that's the value added curriculum,

so if you can develop something like that, that is going to be very powerful. An example would be to design a project for my students (aged 12yrs or 16yrs) to do a journey from here to South Africa where I would ask them to develop an itinerary of how they'd actually do that travel. **" Dr Singh, secondary teacher**

There are many online resources available to teachers i.e. BBC and Google. However, the materials are not personalised for each teacher and thus, teachers are forced to use a set of online materials over and over again.

*"At the moment most of the teachers are exposed to the BBC site or Google, and I feel that there are a lot of applications, some teachers doing this but next year another teacher will be using the same resources and maybe if there was a system like yours <teachers search tool> we could say that hold on, lets go to that as our first portal.***" Dr Singh, secondary teacher**

Moreover, to personalise their teaching materials, teachers have to take the long and uncertain journey of searching other sites in order to bring relevant pieces together to create their personalised teaching material.

*We've got a lot of resources electronically but it's all over the place. At the moment we need to pull it together. Any system which would allow us to do that, and I think that what's needed is to have the conversion systems coming to one place and I think that's the challenge for us and I feel that's where we are.***" Dr Singh, secondary teacher**

The main problem with the current search engines from the teachers' prospective is that the current online resources are vast, time-consuming and above all do not reflect on the needs of teachers in particular. For teachers, the best online search engine is regarded as one that reflects specifically on teachers' needs and their individual preferences together with additional features like printable worksheets.

"I think with Google, what I would love is an extra educational bar. Extra button, which would reflect on me more as a teacher, Google does, not, there is

*nothing like for a teacher Google. At the moment it is too cluttered (untidy), you can find them but it's like a big journey to get to there. I think at the moment there are a lot of teaching but no resource to give to the kids. That's the most important thing. What we want is a button, which says print resource sheet, which you can use within the lesson. There should be a huge button saying print worksheet, it's too complicated.***"**
Dr Singh, secondary teacher

1.6   CONCLUSION

Following our preliminary research, an adaptive search tool designed specifically for teachers has been proposed for the iClass system. iClass stands for "Intelligent Distributed Cognitive-based Open Learning System for Schools" and is funded under the FP6, the European Community Framework Programme for Research, Technological Development and Demonstration. The project is united under a consortium lead by Siemens Business Services. It has 22 partners from 11 different countries that are working to develop an intelligent cognitive-based open learning system and environment, adapted to individual learners' needs at a European level. (For more information please visit www.iclass.info)

The "Teachers Search Tool" will act as an extra feature built on top of the iClass's search engine to personalise teachers' search results by providing the opportunity for teachers to search specifically for "Cross Curricula", "Differentiated" and "Project-based learning" materials. Moreover, the teachers search tool will only be available to teachers via the iClass portal. However, this does not mean that their search results will be restricted to iClass materials/objects, since the aim of the iClass system is to allow its users to search from other repositories outside of the iClass environment i.e. Google, BBC.

Furthermore, to avoid eliminating the "chaos factor" of being a teacher when searching online (that is the possibility of finding other relevant materials by chance), teachers will have the option of turning "Teachers Search Tool" on/off, at any time during their search.

"Great teaching does rely on the chaos factor, we

have to be open to every stimulus ourselves. **" Mr Beadle, secondary teacher**

To further investigate "how do teachers 'personalise' to the needs of their students and the classroom in general?" one hundred questionnaires will be distributed among PGCE students (teacher trainees) at the Institute of Education, University of London, whom are considered to be our future teachers. The PGCE students will be from three different disciplines; primary, secondary and post-compulsory level.

The finding from the above empirical research will enable us to specify the necessary functionalities requested by teachers. This would then be implemented in our prototype for further analysis and recommendation.

1.7   SUMMARY

In this paper we have demonstrated the need to have an adaptive search engine for teachers. The current available 'Adaptive Hypermedia' has been discussed together with their disadvantages. In the end "Teachers Search Engine" (a third solution) has being proposed via the iClass system as the portal to allow teachers accessing the adaptive search engine, which is specifically designed to target teachers' needs. Thus, bridging the gap between the learners and teachers needs.

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