Applying a User Centered Methodology to the Development of Mixed Initiative Web Interfaces for English Education

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Abstract

This paper describes the application of a user centered methodology to the design of mixed initiative web interfaces for English education. While user centered design methodologies are common for general web design, mixed initiative systems are generally developed within the artificial intelligence community with designs focusing on functionality rather than end user satisfaction. As a result, the usability of these systems is poor and real-world users are unable to make proper use of the systems. These systems cannot be thought of as 'true' mixed initiative since a user initiative cannot be adequately combined with artificial intelligence. This paper describes our efforts to address this issue using a case study focusing on English teaching and b-learning. This involves the use of interviews, questionnaires and focus groups aimed at involving users during successive stages of a prototype life cycle development model. The resulting interface is found to be more accessible and generally more useful for our target user groups of students and teachers.

Keywords: Mixed Initiative, User Centered Design, Adaptive Web Interfaces, Planning, b-learning

1 Introduction

Education plays an important role in multiple aspects of development and infrastructure. However, in order to encourage people to learn and take part in the educational system it is important to provide them with the tools they need to learn whilst taking into account different styles of learning [1]. Adapting educational activities to individuals is not easy since each one of us has different educational needs and requirements. Nonetheless, recent years have seen a dramatic rise on the use of information technologies for teaching, particularly for the use of e-learning and b-learning [2]. These technologies are being developed and adapted for the use of a growing number of organizations for both internal training and education. While each different mode of education has its relative advantages and disadvantages regardless of the method of

delivery, it is important to deliver the right tools necessary for people to achieve their desired learning objectives. Here, the degree of communication between student and teacher is essential.

One of the main platforms of communication between teachers and students during the e-learning process are Learning Content Management Systems (LCMS) [3] These allow the reuse and share of e-learning content center held in a central repository. Popular LCMSs include Moodle, Chamilo, WebCT, Sakai and Claroline [4]. These do not however display or allow for the management of learning activities sequences adapted to individual students profiles and only allow the teacher to develop a generic sequence for a whole group. A more flexible approach, known as mixed initiative e-learning [5], combines Artificial Intelligence (AI) techniques with LCMSs to adapt learning sequences to individual student needs. There currently exist a number of e-Learning systems that use Planning and Scheduling (P&S) techniques [6,7] to make smarter sequences of activities in a course to meet the needs of individual students. However, the majority of these systems were developed considering the functionality of specific learning objectives without taking into account the satisfaction of end users. These systems are limited in their capacity to function in an e-learning context due to the limitations of their interfaces which are not properly adapted for public use. An example of such an interface can be seen in Fig. 1. This is a prime example of an interface developed by software developers *for* software developers with an excessive amount of poorly distributed information, making it difficult for users to understand or operate [8]. While these interfaces are often described as being 'mixed initiative', we believe this to be a misnomer since it is difficult for normal users to take the initiative in their part of the interaction due to usability limitations. For this reason we describe the interface we plan to develop as being a *true* mixed initiative interface, using AI techniques such as P&S and agents that interact with these interfaces. This paper describes how our true mixed initiative interface is developed through the adoption of a user centered methodology [9] based around a Visual Ethnographic-Contextual study including interviews, focus groups and low-fidelity prototyping.
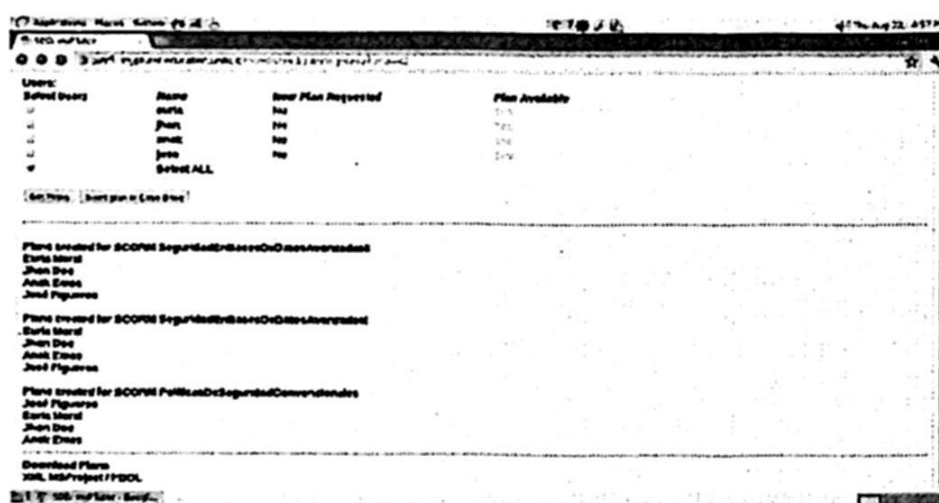

Fig. 1. A typical Content Planning Interface. Here we can see evidence of information overload, ill-considered distribution of components and an un-intuitive layout, contributing to an overall poor user experience.

2   Case Study

As a case study for our true mixed initiative interface we are developing an on-line course generation/adaptation module for a Virtual Campus e-learning environment. This will provide the necessary tools to allow teachers and students to extend both the coverage and scope of teaching/learning while providing a satisfying user experience. As part of an initial requirements analysis for this project, we found that undergraduate students in our university do not have a consistent interest in learning English and do not make a proper effort to learn. A sufficient knowledge of English would only become important after a student graduates, or whenever it becomes a mandatory requirement in order to obtain their degree. Taking advantage of the Virtual Campus b-learning environment based on the LCMS Moodle used in our university, we have developed a prototype mixed initiative on-line course generation/adaptation module.

3   Methodology

The overarching objective of our research is to tackle the problems of English language learning in our university through an improved understanding of the requirements and activities of students and teachers, and use this information to develop adaptive mixed initiative e-learning interfaces. For this, our methodology process began with a Visual Ethnographic-Contextual study, interviewing seven teachers from our university's Language Center. This was followed by the application of two different questionnaires to a group of thirty three PETB (intermediate) level students. These were a Felder and Silverman learning style questionnaire and a multiple-choice questionnaire based on the Iceberg Theory [10] to try and understand the student' thoughts on English learning and the use of technology. The objective here was to develop an understanding of how students learn, and use the results to support our teachers in the development of their work.

Our choice of a Felder and Silverman learning style questionnaire was made in order to assess the adaptability of students. This was important since adaptability is generally crucial for a student to perform well in an e-Learning environment. The Felder and Silverman test is also known to work well with engineering students, and the majority of our students are from an engineering or scientific background. Our other questionnaire took into account the Iceberg Theory [10] to consider aspects such as action, environment, communication, solving problem and thinking.

4   Results

Figure 2 shows an English teacher at our university being interviewed in her normal working environment. Our typical teacher profile was found to be foreign (usually from the United States), aged between twenty-nine and sixty-one years old, with at least a bachelor degree and a teaching English as a foreign language (TEFL) certificate. From the interviews we found that these teachers considered that the methods

and resources for teaching and learning of English in the university are not always relevant. They considered that classes alone are not enough to learn English and that, if a student is to be successful, they should really be able to apply more of their personal time to learning. Teachers felt they needed to adapt their learning materials to a Mexican context in order to attract students and take account of the students' course of study, so they could incorporate interesting course material into study programs. The teachers also had the feeling that the books and materials used for learning English were not suitable. The teachers were not able to customize their learning materials, and felt that resources did not reflect the students' natural learning style. They also had a larger number of students enrolled in courses (between 30 and 100 students for each teacher) and found that it took too long to mark assignments. Another problem was that the teachers did not have the necessary computing equipment or software to provide additional support to classes. Moreover, whenever such materials were made available, students did not make use of them. Despite this, all the teachers are motivated to teach their native language and would work hard to improve the courses wherever possible. They would often share advice and discuss their work amongst themselves and they considered technology as a great way to attract the attention and interest of the students to encourage a more active participation in English language learning.

Fig. 2. Interview with an English teacher (left) in her normal working environment.

The students involved in our study were Mexican (twelve men, eleven women), aged between eighteen and twenty four studying for a bachelor degree. The results of the Silverman and Felder questionnaire were that pupils tended to be, for the most part, active, sensory, visual and sequential learners. Students also preferred to work in teams, liked to learn through real-life events, learned best by seeing pictures and diagrams, and learned in small steps with a linear progress. The results of the second questionnaire told us that: 65% of our students believed they already had enough classes to learn English and only 13% spent more than an hour a day in personal study. 100% of the students told us they enjoyed learning English and were motivated because they wanted to learn a new language (31%), travel and see other countries (25%), work in a transnational corporation (20%) or simply graduate from university (12%). 60.86% of our students considered learning English difficult. This was mostly due to the fact that they could not find the time for private study due to the accumula-

tive workload from other courses. However, all of our students considered it important to learn English in order to develop professionally, and they spent a lot of time on social media, watching videos, listening to music in English, interacting with peers and posting online.

5 Implementation: A 'true' mixed initiative b-learning interface

According to the results of our interviews and questionnaires, we began to develop mixed initiative learning management system interfaces that combine artificial intelligence with teacher input to cater course material to the needs of individual students. Once implemented, this will involve the creation of generic models for adaptable systems to be used in a university environment. These systems will be both easy to use and intuitive for lecturers and students alike; provide intelligent content and learning activity sequences to lecturers and students; and allow lecturers to adapt course content in order to improve the educational experience of the student while elevating some of the logistical problems associated to a larger student to teacher ratio. We aim to assure that these interfaces comply with real world user needs by continuing to enact a user centered approach to requirements analysis, development and evaluation of software prototypes.

Another important aspect being considered is that the interfaces should allow a teacher to work with agents and collaborate to generate an appropriate Learning plan for each student. Agents should be able to support the teacher in the preparation of their working material. On the other hand, agents should support students in their continuous evaluation and the adaptation of learning material to each students as well as monitoring their progress.

Throughout this work, feedback and involvement from users has been crucial for enabling interfaces to meet the needs and requirements of actual system users. So far we have conducted usability tests using low-fidelity interface mockups and card sorting [11] involving usability experts, teachers with experience of e-learning and sample users from the languages department (see Figure 3).

Fig. 3. Usability tests with paper prototypes and sample users from the languages department.

The results obtained during the early usability tests were taken into account in order to improve our interface by adapting it to the vocabulary of the users and organization

of the interface. These early studies also helped us refine our understanding of the initial user requirements. Latter usability tests were performed with medium fidelity prototypes. The results of these tests were that 60% of users did not like the distribution of elements and colors used and all users found it necessary to include technical support options with more intuitive controls and operational mechanisms. Before testing, we expected figures around 70% of approval. Results were not as expected, so changes must be made. Figure 4, 5, 6 and 7 show the evolution of the interface through various prototype stages, according to the users' feedback.

The users had a positive reaction after seeing the final prototype and were encouraged by the idea of using a mixed initiative b-learning system for their courses in the future.
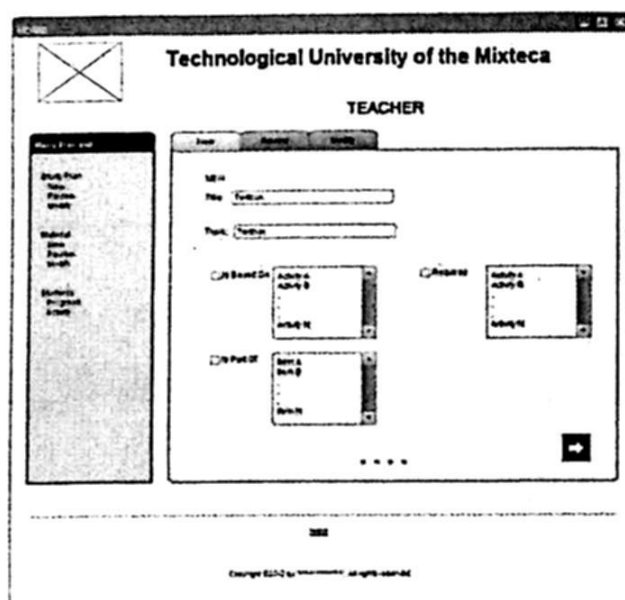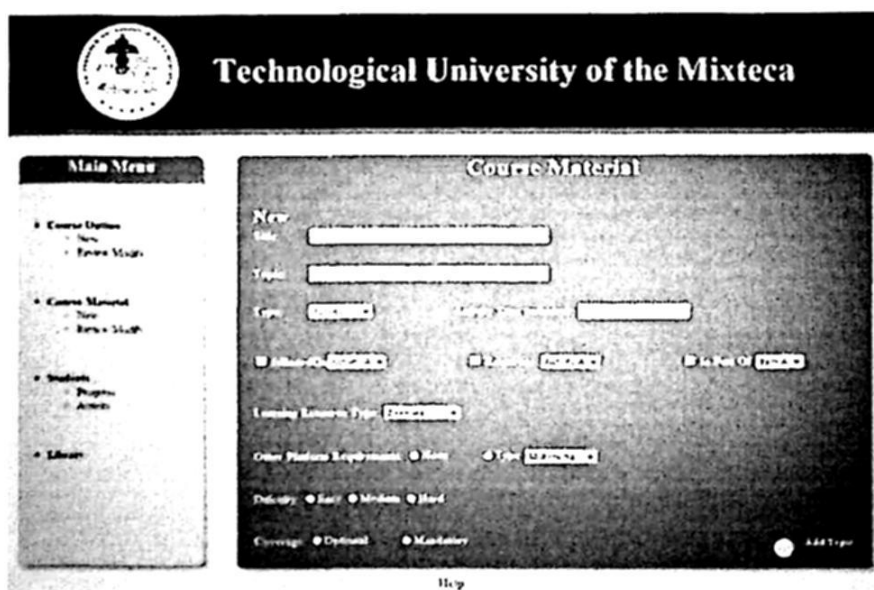

Fig. 4. Paper prototype.
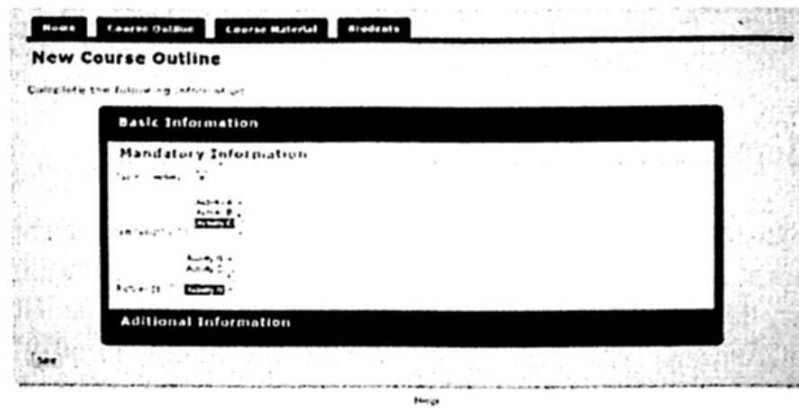

Fig. 5. Medium fidelity prototype.

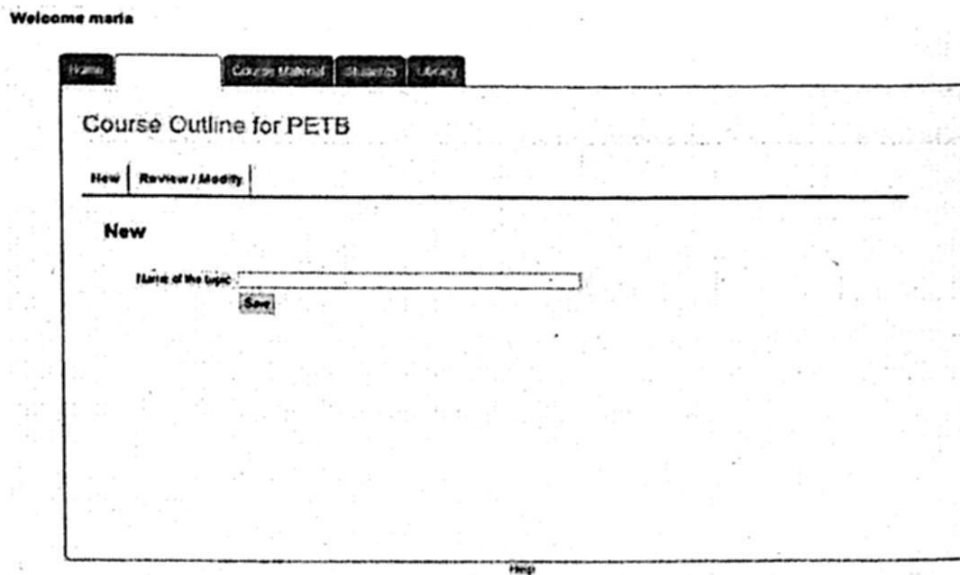Fig. 6. Initial working prototype.

Fig. 7. Further refined working prototype integrated with Moodle LMS.

6   Conclusions and Future Work

Due to the need for what we have called a *true* Mixed Initiative e-Learning framework (i.e. with an usable accessible interface), we are developing a number of interfaces prototypes using a user centered methodology. These interfaces show the potential of Mixed Initiative to improve the overall user experience, making it possible to allow teachers to adapt the content and sequence of learning activities for students, to students by making course material more relevant, and at the same time helping to resolve their own workload issues by increasing the capacity of students to work independently, although further work is needed.

These early results show great promise for the development of our final prototype, which will include a full implementation of a mixed initiative system that combines artificial intelligence controlled course sequence planning with human input. This will be evaluated using a full ethnographic study to assess the extent to which a mixed

initiative enabled adaptive systems can improve the educational experience of both lecturers and students.

Acknowledgements

References

1.   González, S., Heras, L.: La Universidad entre lo Presencial y lo Virtual. Universidad Autónoma del Estado de México (2006)
2.   Fernández-Pambillón, A.: Las plataformas e-learning para la enseñanza y el aprendizaje universitario en Internet. Universidad Computense de Madrid (2009)
3.   Robbins, S.R.: The evolution of the learning content management system. Learning Circuits (2002)
4.   Kušen, E., Hoic–Bozic, N.: In search of an open–source LMS solution for higher education using a criterion–based approach. International Journal of Learning Technology 7, 115-132 (2012)
5.   Garrido, A., Onaindia, E., Morales, L., Castillo, L., Fernández, S., Borrajo, D.: Modeling E-Learning Activities in Automated Planning*. (2009)
6.   Garrido, A., Morales, L., Serina, I.: Using AI Planning to Enhance E-learning Processes. Twenty-Second International Conference on Automated Planning and Scheduling (ICAPS), AAAI Press, 47-55 (2012)
7.   Gorayska, B., Mey, J.L.: Cognitive Technology: In Search of a Humane Interface, North-Holland (1996)
8.   Almenara, J.C.: Bases pedagógicas del e-learning. Revista de Universidad y Sociedad del Conocimiento, RUSC 3, 1 (2006)
9.   Nielsen, J.: Usability Engineering. Academic Press Professional, Boston (1993)
10.   Rader, D., Harris, L.: New Kid in School, Teachers College Press (2003)
11.   Usability.gov: Your guide for developing usable & useful Web sites. Card Sorting.   At   http://www.usability.gov/methods/design_site/cardsort.html.   Link accessed on February 10, 2013