Open issues in personalized inclusive learning scenarios

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Abstract. This paper discusses some of the existing open issues in personalized inclusive learning scenarios that are being worked in the context of A2UN@ and ALTER-NATIVA projects by a joint collaboration among the aDeNu research group at UNED and the BCDS research group at the University of Girona.

1 Introduction

Accessibility, adaptation and learning are three interrelated issues with a growing interest in our society. Unfortunately, in Higher Education (HE) institutions, Information and Communications Technology (ICT) services are still not fully accessible to an increasing number of students whose main educational option is distance learning (in Spain roughly 50% of students with disabilities select distance learning).

At the aDeNu research group (which stands for 'Adaptive Dynamic online Educational systems based oN User modelling') of the UNED (Spanish National University for Distance Education) we have been actively involved in providing personalized and accessible services for life long learning [1]. In turn, the BCDS (which stands for 'Broadband Communications and Distributed Systems') at the University of Girona focuses on adaptive models for collaborative distance learning and dynamic adaptive hypermedia systems. In order to tackle the open issues in personalized inclusive e-learning (PIL) scenarios both groups are jointly researching in the context of the A2UN@ and ALTER-NATIVA projects.

A2UN@[1] is a research project (TIN2008-06862-C04-00/TSI) funded by the Spanish Ministry of Science and Innovation and stands for Accessibility and Adaptation for ALL in Higher Education. A2UN@ objective is to analyze the

[1] A2UN@: http://adenu.ia.uned.es/web/en/projects/a2un

capability of developing a general framework based on standards and user modelling, to support the development of the lifelong learning services required to attend the accessibility and adaptation needs for all in the university context, with special attention to the diversity of requirements of adult learners and those who have the so-called disabilities. In particular, the key objective of A2UN@ is to develop the required interoperable and layered-based infrastructure to facilitate the definition, development, deployment and evaluation of the services to be provided for supporting accessible and personalised learning in higher education [2].

ALTER-NATIVA[2] is a research project (DCI-ALA/2010/88) funded by the European Commission ALFA III program to stimulate the improvement of quality in higher educational institution in Latin America. The main objective of this project is to support teachers of diverse subjects (e.g. language, arts, science and mathematics) in their educational tasks to cope with learning contexts with diversity requirements (such as accessibility, multi-linguism, poverty, forced displacement, etc.) by means of ICT as a key element in the learning process.

In this paper, we introduce the open issues identified in the context of the A2UN@ and ALTER-NATIVA projects and the research works carried out in them to support PIL scenarios.

2 Open issues and research in the A2UN@ project

In the context of the A2UN@ project, the following open issues have been identified [2]:

1. The need of support for describing and managing accessible and adaptive learning scenarios.
2. The existence of overlapping and contradictions between available standards to manage accessibility issues and dynamic support in terms of i) users' models, ii) learning scenarios, iii) interaction preferences, iv) devices capabilities, and v) metadata for specifying the delivery of any resource to meet users' needs.
3. The lack of frameworks for providing layered-based infrastructure covering the interoperability required to manage the whole range of standards, applications and services needed to meet accessibility and adaptations needs of lifelong learning services.
4. The availability of limited research on constructing adaptive learning scenarios to manage accessibility issues (including artificial intelligence techniques such as machine learning, web-mining, and multi-agent systems).
5. The shortage of best-practices in developing and providing accessible and adaptive learning scenarios that counts with the participation of different types of users on the demand side (students with special needs) and different existing roles on the supply side (administrators, faculty staff and specialized support people in providing the services).

Several works have been carried out to address those issues and support PIL scenarios in the context of the A2UN@ project. First, we have analysed the existing support

[2] ALTER-NATIVA: https://adenu.ia.uned.es/web/en/projects/alter-nativa

offered by standards and specifications that impinge on accessibility issues regarding users' models, learning scenarios, interaction preferences, devices capabilities, metadata for specifying the delivery of any resource to meet users' needs, and software accessibility and usability [3]. This work has confirmed the lack of standards that are oriented towards users and developers, and also addressing all areas of modelling treated, as well as the existence of many conflicting standards that address the same issues but with different views. Another study focuses on standards supporting the interaction between the user and the e-learning system also reports that today there is no single standard able to model this context and the application of a combination of several of them results in overlaps and gaps [4].

Moreover, the research has also focused on building a user model for students performing learning processes in virtual learning environments that manages the cognitive performance of each student considering four cognitive areas related to the attention capacity (i.e. verbal learning, working memory, concept shifting and sustained attention) [5,6].

Furthermore, in conjunction with the EU4ALL project, we have researched and developed a flexible framework to cope with different scenarios for inclusive learning designed to support the needs of the stakeholders involved, both students and professionals [7]. This framework uses existing standards to define and implement an open and extensible architecture of services for accessible lifelong learning.

We have also coined the concept of Semantic Educational Recommender Systems (SERS), which based on educational criteria, guide learners in their interaction within e-learning platforms by providing personalized and inclusive recommendations that could target any possible actions within an e-learning platform [8].

3 Planned research in ALTER-NATIVA

ALTER-NATIVA project has two different and important dimensions to be addressed, that is, the pedagogical and the technological dimension. The principal objective of the pedagogical dimension is to define a set of referents or guidelines which could be used for teachers in order to apply the most common technologies in the learning process. In turn, the technological dimension must address the educational contextual diversity existing in a virtual learning environment taking into account the most relevant features of the system actors such as students and teachers. In this context, educational needs on diversity are understood as the result of physical, physiological, sensorial or social conditions that put people in special situation for accessing knowledge, cultural or social relationships.

Based on previous experience in the A2UN@ project, the technological developments of the ALTER-NATIVA project focuses on three major research and development lines: i) the user modelling process, ii) the learning objects construction and labelling, and iii) the generation of adaptive learning experiences to meet user needs represented in the model. Moreover, the ALTER-NATIVA project takes advantage of the diversity of the specialists in different field of people behaviour to address user and context modelling processes not consider in the A2UN@ project.

Moreover, ALTER-NATIVA addresses some other open issues. In particular, Latin American culture poses special conditions such as multi-lingualism, which is defined by the presence of different indigenous communities that have preserved their language over time. In particular, Mexico and Bolivia count with 87 different languages. This fact expresses the importance of the inclusion of user model features related with the language such as reading or writing ability, or the possible reduction of this ability because of the use of a second language or cognitive traits involved in a multi-lingual educational process. Thus, the Latin America special social context requires knowing special access conditions, not limited only by the technologies available but by poverty and forced displacement, among others. These conditions must be identified and represented. It is our intention through an intensive context modelling to consider the necessary dimensions to support Latin American Education.

Populations with disabilities are also considered in the context of ALTER-NATIVA project. The state of the art considers the identification and evaluation of assistive technologies to enhance learning process for people with visual and hearing disability and people with Attention Deficit Hyperactivity Disorder (ADHD) symptoms. User modelling and adaptations based on machine learning techniques, image recognition and augmented reality have been considered.

Another important issue to be covered by this project is the construction of accessible learning objects to support the learning process. ALTER-NATIVA validation scenarios consider a special population, which are students learning to become teachers which aim to teach math, science and languages. In this way, the methodology of appropriation of learning objects focuses on two important issues. On the one hand, the existence of distributed learning objects, which should be retrieved smartly; and on the other hand, the construction itself of the specific accessible learning objects. To address the first issue agent-oriented methodologies have been considered in order to achieve federated searcher engines. For the second issue, Web Accessibility Guidelines 2.0 (WCAG 2.0) have been considered. Hence, user modelling process and accessible learning objects are the bases for delivering adaptive learning experiences to users. These experiences include adaptive learning path, adaptive games, and adaptive grouping experience, among others.

4 Summary

In this paper we have presented the works carried out by aDeNu and BCDS research groups aimed to support PIL scenarios. These works are framed in the context of A2UN@ and ALTER-NATIVA projects. In the former, we have identified five open issues and have worked on several dimensions to address them, such as the analysis of existing standards, the building of user models, the definition of educational services and the application of semantic educational recommender systems. In the ALTER-NATIVA project (just started) we will continue working on those issues to support teachers of diverse subjects (e.g. language, arts, science and mathematics) in their educational tasks to cope with learning contexts with diversity requirements (such as accessibility, localisation, etc.) by means of ICT as a key element in the learning process.

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