Empowering disabled people: e-learning challenges for independent life

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Abstract. This paper presents a solution to address the technological challenges to support the needs of people with intellectual disabilities towards an independent life, in the scope of the CISVI research project, which proposes a new research methodology to deal with the needs of disabled and social communities.

Keywords. CISVI, ESdI, independent living, inclusive learning

Introduction

Research in Advanced Learning Technologies (ALT) could have a direct impact on the improvement of the quality of life (QoL) of disabled and non-disabled people. QoL represents the degree to which an individual can establish and sustain a viable self in the social world [1]. However, technology is very often not ready to support the final user in this way.

In this context, at the aDeNu group we are doing advanced research on the Information and Communication Technologies (ICTs) to foster the inclusion into the society of people with cognitive and physical disabilities. At present, we are involved in the CISVI project (TSI-020301-2008-21), which faces different issues related to the inclusion of the disabled people using the ICTs.

This paper addresses the challenges to help people with intellectual disabilities (PID) in easily learning the activities of daily living (ADL).

Research Communities for Health and Independent Living

The main goal of the *Research Communities for Health and Independent Living* (CISVI) project is to identify, test and validate a new methodological research framework named *Social Spaces for Research* (ESdI) in three scenarios: i) labour integration of people with cognitive disabilities (ESdI1), ii) home healthcare for elderly people (ESdI2), and iii) living independently (ESdI3).

The research activity carried out within the scope of these three ESdIs pose important contributions in the following areas of technology and its adaptation for elderly or to people with some kind of physical or intellectual disabilities:

- Intelligence Environmental Technologies: RFID, mobile sensors, etc.
- Mobile devices for accessing ICT suitable for meeting the needs of people with disabilities and dependence
- Accessibility, usability and user modelling technologies
- e-learning and e-mentoring ubiquitous technologies, adapted to people with disabilities and dependence
- Tracking and geographic information technologies
- IT security and identity

The primary objective of ESdIs research framework is to encourage the involvement -from the very beginning of the research activities- of the end user as co-creator of the services [2].

In this paper, we are focusing on discussing how Esdl3 is addressing independent life improvements of PID. Elsewhere it is described the Esdl1 approach, where adaptive e-learning and e-mentoring to support people's work integration is provided in terms of recommendations [3].

EsdI3 Scenario: living independently

The educational scenario is located at the ATADES-Santo Angel[4] occupational centre for adults in Zaragoza, Spain. This centre has a long experience, and takes in people with heterogeneous intellectual disabilities for their long life learning. It offers training on general and social abilities, workshops, therapeutic activities, physical exercises and handcraft works for commercial companies. The goal is to facilitate the integration of PID into the community. Currently, about 200 people, ages ranging from 21 to 65 years old, with an average of 40, are in the centre. The professional team includes educators, psycho-pedagogues and managers.

The investigation on key technologies aims to promote independent living for elderly and disabled people with the least possible assistance. According to the law of dependence [4], different technological supports need to be provided:

- Educational support for learning basic daily life activities (health and hygiene, autonomy in food, dress)
- Educational support for learning instrumental daily living activities (cooking autonomy, home order and cleanliness, using the telephone)
- Educational support for learning advanced daily living activities (eating habits, food choices, make a shopping list, communication, leisure, tasks management, orientation, mobility)
- Personal Safety support:
    - Detection of risk situations focusing on the individual person: fall detection, abnormal behavior (for example, a long time without getting out of bed), etc.
    - Risk detection focusing on the setting: cold / heat (for example, because of a window which has been left opened) fire, smoke, etc.

4 ATADES - http://www.atades.org/

- Detection of risks which may come from an external situation such as burglary; abnormal presence detection.

The first experience supports the ADL of washing-up the hands. A touch screen hanged on the bathroom wall displays the sequence of steps to follow the activity.

Figure 1. The "how to wash your hands, step by step" lesson

The use of the ALT has a twofold impact, i) as a complement to empowering personal capabilities (abilities) and ii) as a tool for professionals that facilitates the follow-up of the global process. The goal of the training is the acquisition of abilities for daily independent living, but, depending on each person and the nature of their disability, ALT can contribute to:

- Recalling in a continuous life-long learning process
- Reinforcement for achieving trust in one self
- Support for reducing their dependency level
- Independent living, with the acquisition of the learned ability

Supported Technology

Educational supports are based on educational units in which different contents are presented, such as:

- Videos of different daily activities in which different disabled people are performing daily tasks. These videos help to reinforce activity learning.
- Audio with tasks carried out in the different stages of daily activity.
- Images with pictures of disabled people executing these tasks. These images are complemented by iconography, based on augmentative language, according to the user-centered design principles.

Devices which contain this interface consist of tactile screens with Wi-Fi connection, adapted interfaces such as: a switch adapted mouse, a virtual mouse, etc

It should be noted that all the contents are shown according to the location of the user, by using location systems.

On the other hand, personal safety support is based on ICTs, such as: location systems, movement and presence sensors, flood and smoke detectors, actuators, etc.

Activities during the project life cycle

Within the project there are several phases in which successive iterations of short-term working periods evaluate the results within its phase, in order to improve the technological solutions and find new sustainable ways to perform the solution.

As a result of the sustainable development of the ESdI, results will be shared within an open community of users and will be extended to other associations and related foundations.

The project is in the first 6 months of its development, and has achieved:

- The development of a technological support for teaching and learning basic daily activities such as "how to wash your hands, step by step". ATADES Association, UNED[5], FZCC[6] Foundation and University of Zaragoza[7] have taken part in this interface development
- A survey and evaluation of accessibility and usability of the interface with the assistance of the ATADES multidisciplinary team, which suggested improvements.

Currently, the evaluation of the interface with real users is being conducted at ATADES-Santo Ángel Occupational-Centre.

It is planned that the ESdI evolves as follows until 2011:

- Continued development of the interface in ATADES-Santo Ángel Occupational Centre, extending it to other activities (educational support for learning basic and instrumental daily living activities).
- Support for independent living in the residential centres of the ATADES association.
- Support for independent living in private homes and supervised apartments.
- Support for independent living in flats of Valdespartera.

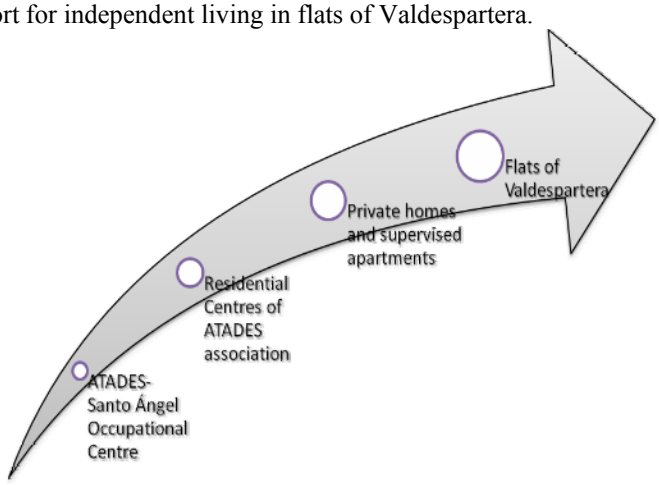

Figure 2. The ESdI-3 life cycle

5 Spanish National University of Distance Education - http://www.uned.es/

6 FZCC - Foundation Zaragoza City of Knowledge - http://www.fundacionzcc.org/

7 University of Zaragoza - http://www.unizar.es/

Needs and Challenges

In order to understand the needs of PID and provide some technological solutions to address them, we have carried out observational sessions at the occupational centre and had interviews with the professional team.

After this process, the main conclusions we have gathered are:

- Once PID are given some guidelines for working, they follow them without exception.
- PID require additional effort to modify a learnt guideline (i.e. their capability to adapt to the environment is limited)
- PID require alerts and reminders of the activities at each time.
- Professionals look after the tasks and check if they have been carried out successfully.

In this context, a set of challenges for the ALT appear to address functional diversity of PID:

- Differences in user-agents (e.g. browsers) should be transparent to the users
- Multi-media resources should be offered
- Multi-modal interaction should be provided
- Heterogeneous learners' cognitive levels should be taken into account
- Contents and presentation should be adapted for each learner according to the learner's features (i.e. learner profiles managed by user modeling techniques)
- Contents have to be frequently and continuously updated to cope with the changes in the environment and the processes
- To facilitate the continuous updating, educators need to have a repository of learning objects conveniently marked with the metadata for the user profile of each student.
- Educators also need an editor accessible and usable to provide a quick update.

Solutions at the CISVI project for Esdl3

The solution offered during the first stage of the project consist of: i) elaborating the template with the sequence of steps corresponding to a particular activity, ii) developing the learner profile, which includes the personal features that constrain the learning process, iii) selecting 6 PID from the occupational centre and describing their profiles, iv) specifying the most adequate tutorial for each one, v) developing each tutorial and vi) documenting the whole process for adapting contents and their presentation to the learner's needs.

The elaboration of the template was a process shared between the technological and educational partners, following a process of creation and revision.

Each step of the template is a web page that incorporates multiple resources in different media (text, image, audio, video and iconography for augmentative communication). Moreover, the template includes different options for presenting the information, regarding colours, position of items in the screen, or navigation icons. Figure 1 shows the first slide for the washing-up hands activity. The navigation between the steps can be done by multiple modalities: mouse, keyboard, voice, tactile interaction, physical button or a time deadline.

This scenario requires a level of extreme personalisation to facilitate the complete adaptation of the resources to the individual: each user interacts with their own images and videos performing the activity; the time deadline for the automatic navigation is adjusted to the user pace on each step of the activity; the audio is the known voice of the educator; images identifying locations are from the real scenarios.

This extreme personalisation of the solution poses the following challenges:

- ALT need to include a repository of media resources with metadata that relates each media to the user or group of users, and from the template and the search on this repository generate the lesson for each user.
- Facilities to support adaptations provided by the educator, thus the system needs to be flexible, configurable; it needs to provide the tools that facilitates the educator the easily modication of the application objects.
- Tracking user's interaction and providing recommendations from the recommender system. Several recommendations can be provided. For instance, advising the educator for configuring some parameters (e.g. the adjustement of deadline times for each step of each people).
- The cost of building and deploying all media resources is very high.

To date, experiences have been performed with 6 people. First, the activity was performed in a natural way; next the activity was repeated using the guide of the educator, and finaly with the use of the deployed technology. The experiences were recorded and analysed, so that conclusions can be drawn to improve the process. The experience proves the importance of the user-driven approach. Some of the developed enhancements are as follows:

- New steps included in the process.
- Detection of lack of recognition for some pictures (i.e. image with the name of a location replaced by the location itself)
- Different deadline times for each user
- The attention is centred on the audio more than on the image

Conclusions and future works

From our experience in the CISVI project, we have come to the following conclusions:

- The individual differences of each user have to be taken into account from the ouset.
- Combining design for all approaches with personalization features provide solutions that are able both to comform different types of needs from the design viewpoint and support their adaptation to the specific needs of the user while the interaction takes place.

Future works deal with several cycles of experimentation and refinement, extension to other ADL, introduction of mobile devices, and dynamic support through recommendations.

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