A User-Centred Approach For Developing Advanced Learning Technologies
Based On the Comprehensive Assistive Technology Model

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Abstract

Learning technologies are becoming increasingly important in education. Many disabled people experience barriers in accessing education and therefore these learning technologies need to facilitate access to education for disabled people rather than generate additional barriers. There is therefore a need for development and evaluation methodologies for advanced learning technologies which take account of the needs of disabled people. The main aims of this paper are the presentation of a user-centred design approach for (advanced) learning technologies and its link to the Comprehensive Assistive Technology (CAT) model developed by the authors and a user-centred evaluation methodology for learning technologies based on the CAT model.

1. Introduction

The use of learning technologies is becoming increasingly important in educational practice. These technologies need to be fully accessible to disabled people, including people with learning disabilities. Learning disabilities can be divided into specific and general learning disabilities. The main types of specific learning disabilities are dyscalculia or mathematics learning disabilities and dyslexia or literacy learning disabilities. A sizeable group of people with dyscalculia also have dyslexia. There is a need for tools that can support both the design process for new learning technologies and evaluate existing technologies. The paper aims to use the Comprehensive Assistive Technology (CAT) model developed by the authors [2,3] to do this.

The CAT model gives a comprehensive description of an assistive or other technology system in terms of the person using the technology, the activities they are carrying out, the technical, end-user and other specifications of the technology and the context in which the technology is being used. The person, context and technology components of the model are as follows:

1.1. Pedagogy of Diversity

People with specific learning disabilities have particular cognitive approaches and therefore need learning approaches and technologies which are compatible with their cognitive styles. This gives rise to a need for a pedagogy of diversity, based on appropriate learning methodologies and approaches for the full diversity of students and which enables all students to draw on their strengths [4].

All technologies should be both accessible and usable. Accessibility can be defined in terms of the absence of barriers to carrying out a particular activity and the presence of factors, which may be structural or psychological, which facilitate carrying out this activity. Usability is the extent to which a particular group of users can use a particular system in their particular context to achieve specified goals effectively, efficiently and with satisfaction [1, 5]. Both the accessibility and usability of the learning technology itself and the use of the learning
technology to overcome accessibility barriers that could affect the learning process should be considered.

2. Developing Advanced Learning Technologies Using the CAT Model

The approach presented below is iterative and some steps or sequences of steps may be repeated many times.

1. Determination of the learning activity or activities to be supported by the technology. The activity section of the CAT model can be used to define the activities involved. This leads to detailing the task specifications in the activity specification section of the assistive technology system component.

2. Determination of the user requirements in the activity specification section of the assistive technology system component of the model. These requirements can be obtained by referring to the person section of the model and in particular the user characteristics and attitudes.

3. Determination of the context in which the advanced learning technology will be used. This will influence many of the design specifications. The wider and user’s social and cultural context will determine the appropriate language and symbols. The infrastructure component of the national context and the location, environment and physical variables may put constraints on the design.

4. Design specification: this includes the design and system technology issues sections of the assistive technology system component of the model, leading to selection of the design approach, the technical performance requirements, the technology and the system interface. Selection of the system interface will be largely determined by the end-user characteristics already considered.

5. Evaluation of the design in terms of end-user issues, including ease and attractiveness of use and mode of use. This will require consideration of both the end-user characteristics and the context of use.

6. Documentation and training: End user characteristics, will determine a number of important features including the use of alternative format(s) such as video or Braille and the level at which the information is pitched e.g. for experienced or novice users of the technology. Both the local and wider social and cultural context need to be taken into account in determining the appropriate language and symbols for documentation.

7. Construction of the device.

8. Cycle of end-user testing and repeated modifications. This will include evaluation in terms of the assistive technology system components of the model, including end-user satisfaction, functionality and overall design.

2.1. Evaluating Advanced Learning Technologies

The person and context evaluation procedure are presented in the form of a series of questions.

Person: Is the learning technology appropriate for the intended group(s) of users?

Characteristics: Is the technology age-appropriate? What skills are learners required to have? Is this realistic? Has the technology taken into account learners’ impairments? Have learner preferences been considered?

Attitudes: Is the technology appropriate in terms of what is known about the intended learners attitudes’ to learning and the use of learning technologies?

Social aspects: What is the likely education and employment profile of the group of learners? Is this appropriate to the technology in terms of the knowledge, understanding and experience required? What support or encouragement is available to learning in general and using the specific advanced learning technology?

Context: Is the learning technology appropriate to the context in which it will be used?

Social and cultural: Are any examples, symbols, metaphors, graphics and stories culturally appropriate and comprehensible? Have any sources of ambiguity or possible offensiveness been avoided? Is the language used one the users are fluent in?

National infrastructure: Is the available infrastructure able to support the technology? Have any unrealistic assumptions been made? Is it possible to maintain, repair and update the technology locally?

Local settings: Can the technology function under the local conditions, particularly extremes of temperature or humidity? Is the format of the system outputs and inputs appropriate e.g. noise and light levels? What type of learning setting is the technology intended to be used in?

Is the learning technology of a type that is familiar in the local context?

Legislation: Does the learning technology comply with all relevant local, national and international regulations?

References


