Inclusive eLearning – Special Needs and Special Solutions?

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Abstract

In this paper we are answering the question whether special needs require special solutions in Inclusive eLearning. We are approaching the topic by investigating the terms Universal Design, Design for all, Inclusive Design, Universal Access, and eInclusion. From keywords around eInclusion we derive a model of influence factors on a person's eCompetence. Understanding people as individuals with distinct combinations of competences leads to individual, adaptive solutions – in application design in general and in eLearning in particular.

1 Introduction

The workshop series on Inclusive eLearning speaks of "comparable difficulties experienced by very young learners, learners with physical and/or learning disabilities and elderly people when using ICT. Our assumption is that developing computer supported learning environments and utilities for every day life shares more common properties than the diverse target groups let expect."[1]

In order to recognise those comparable difficulties, it might be helpful to refrain from thinking in categories such as "the blind" or "the old" and to understand people as individuals with distinct combinations of competences – not only in daily life, but also in the field of eLearning.

To answer the questions of *what exactly is Inclusive eLearning and do special needs require special solutions*, the remainder of this paper is structured as follows. In section 2 we investigate the terms Universal Design, Design for all, Inclusive Design, Universal Access, and eInclusion. Considering eAccessibility and eCompetence of major importance, we gather influence factors on a person's eCompetence and arrange them into the flower model presented in section 3. Section 4 takes a closer look at Inclusive eLearning to answer the initial questions. An overview of projects on eInclusion and Inclusive eLearning is provided in section 5, before the paper finishes with our conclusion in section 6.

2 Terminology Overview

It is well-known that we live in an information society. Information and communication technologies (ICT) are more and more important in all areas of life and therefore the base for the information and knowledge society we live in. These new technologies provide many advantages – they can help to compensate functional deficits, help to live more independently, and improve the quality of life. They also increase the flexibility and adaptability of employees leading to a better integration into the labour market.

But there are also disadvantages: ICTs hold the risk of separating people, creating barriers, increasing social exclusion – especially for elderly people and those with disabilities but also because of gender, literacy and culture. In general there is a risk of exclusion due to a lack of qualification, impairments and/or missing access to information and communication technologies.

[1] Quote taken from the Inclusive eLearning community platform at http://iel.mixxt.org/.

Due to the demographic situation nowadays, the human rights movements, and the national and international legislation, there are many attempts to better integrate disadvantaged groups. Even though the idea of integrating people is the same in all parts of the world, terminology is quite different. When looking for information on the topic, terms like *Universal Design*, *Design for All*, *Inclusive Design*, *Universal Access*, and *eInclusion* can be found.

2.1 Universal Design, Design for All, and Inclusive Design

The Center for Universal Design[2] defines "The intent of *Universal Design* is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Universal design benefits people of all ages and abilities."

Ronald L. Mace, the design Pioneer and Visionary of Universal Design and at the same time founder and programme director of *The Center for Universal Design*[3], said: "Universal Design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design."

The term Universal Design has its origin in the USA and is based on the following seven principles[4]:

1. Equitable Use
2. Flexibility in Use
3. Simple and Intuitive Use
4. Perceptible Information
5. Tolerance for Error
6. Low Physical Effort
7. Size and Space for Approach and Use

The following definition for *Design for All* is provided by the EIDD, the European Institute for Design and Disability.

> Design for All is design for human diversity, social inclusion and equality. This holistic and innovative approach constitutes a creative and ethical challenge for all planners, designers, entrepreneurs, administrators and political leaders.
>
> Design for All aims to enable all people to have equal opportunities to participate in every aspect of society. To achieve this, the built environment, everyday objects, services, culture and information – in short, everything that is designed and made by people to be used by people – must be accessible, convenient for everyone in society to use and responsive to evolving human diversity.
>
> The practice of Design for All makes conscious use of the analysis of human needs and aspirations and requires the involvement of end users at every stage in the design process.[5]

[2] `http://www.design.ncsu.edu/cud/about_ud/about_ud.htm`

[3] For more details about Ronald L. Mace see `http://www.design.ncsu.edu/cud/about_us/usronmace.htm`

[4] A detailed description of the principles can be found at `http://www.design.ncsu.edu/cud/about_ud/udprinciples.htm`

[5] The EIDD Stockholm Declaration 2004 `http://www.designforalleurope.org/upload/designforall/sthlmdeclaration/stockholmdeclaration_english.pdf`

The British Standard Institute defines *Inclusive Design* as

> The design of mainstream products and/or services that are accessible to, and usable by, as many people as reasonably possible [...] without the need for special adaptation or specialised design[6].

As can be seen here, three different terms exist but only one definition particularly contains the notion to simplify life by designing products, services and systems that are usable by as many people as possible without adaptation. All three terms refer to all areas in life, whereas in our consideration we limit the view only to ICTs.

2.2 Universal Access

As Stephanidis and Savidis mention there are several connotations for *Universal Access*. Due to the great amount of technological developments in all areas of life today many more than just disabled and elderly people may be affected by accessibility problems. Universal Access therefore has to manage the following three requirements [20]:

1. the diverse characteristics of the target user groups (including those with disabilities)
2. the diverse scope and nature of tasks
3. the different contexts of use and the effects of their proliferation into business and social endeavors

In the context of Information Society it is necessary not only to think of accessibility of computers and interfaces but also of the information itself – how it is created, collected, represented, stored, transferred, and used [18]. In general it can be concluded that Universal Access refers to accessibility and usability of ICTs as well as of information-based commodities to anyone, anywhere and anytime [20, 19].

2.3 eInclusion

Also having its roots in Europe, eInclusion[7] refers to all activities that are related to achievements of inclusive ICTs as well as the usage of ICTs. The major aim of eInclusion is to reduce the gap between those who have access and the capability to use modern information and communication tools (telephone, television, internet) and those who do not, including disadvantaged people due to disabilities (eAccessibility), age (eAging), education (eCompetence), gender, ethnicity (socio-cultural eInclusion) or/and those who live in remote regions (geographical eInclusion)

The Riga Ministeral Declaration on eInclusion[8] of June 2006 identifies six themes to be fostered by the European Commission. The overall objectives are:

eAccessibility aims to remove barriers for people with a wide spectrum of disabilities and special needs and to ensure equal access to ICTs for everyone. This includes to facilitate accessibility and usability of ICT by making digital content accessible on all platforms, using interoperable assistive technologies, and consider inclusive design by developing ICT products and services.

In particular for websites the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C) published the Web Content Accessibility Guidelines (WCAG) as recommendations

[6] The webpage `http://www.tiresias.org/accessible_ict/what.htm` gives a brief overview of the terms *Universal Design*, *Design for All*, and *Inclusive Design*

[7] The website `http://ec.europa.eu/information_society/activities/einclusion/index_en.htm` gives a wide overview on eInclusion and the efforts of the European Commission in this matter.

[8] `http://ec.europa.eu/information_society/events/ict_riga_2006/doc/declaration_riga.pdf`

for a barrier-free web accessibility. These guidelines are supposed to be endorsed by industry, research, governments and disability organisations [5].

eAging is concerned with the needs of the elderly as well as of the older worker and aims to make ICT more popular amongst them. ICT entails the potential for elderly people to enjoy a high quality of life and have the opportunity to live independently. But there are still barriers for older people to use the full advantage of the ICTs. Goals of the declaration are e. g. exploiting the full potential of the ICT market by promoting standards and common specifications if appropriate, improving the employability, working conditions, and work-life balance by ICT solutions that can be used everywhere, and increasing quality of life by promoting assistive technologies and ICT-enabled services for integrated social and healthcare.

eCompetence stands for improving digital literacy and competences. People need the proper skills, knowledge, and attitude to get along with ICTs. New technologies which make life and work easier are useless if people are not able to use them properly. eCompetence aims at equal skills and competence to minimize the risk of leaving someone behind due to a lack of opportunities or motivation.

Socio-cultural eInclusion fosters pluralism, cultural identity, and linguistic diversity in digital space. It also pursues the goal of enhancing the possibilities for economic and social participation and integration as well as creativity and entrepreneurship of immigrants and minorities.

Geographical eInclusion is focused on reducing the geographical digital divide by facilitating affordable access to ICT networks and terminal equipment as well as contents and services especially in remote and rural areas.

Inclusive eGovernment Governmental services are more and more organised and delivered through ICTs. It is therefore necessary to consider everybody's needs, including those of disabled people, the elderly, people in economically disadvantaged and remote areas as well as other groups of vulnerable and disadvantaged people. A user-centric and inclusive way of designing and delivering services is necessary to achieve this. Another point is to ensure an appropriate format of electronic documents so everybody, including people with disabilities, can use them. Another important aim of Inclusive eGovernment is to increase the awareness of digital network and information security by disseminating user-centric security concepts.

We believe the main keywords here are *eAccessibility* and *eCompetence*. "e-producers", on the one hand, are responsible for ensuring equal access to ICTs for everyone – eAccessibility; "e-consumers", on the other hand, need to have sufficient skills and knowledge to use ICTs – eCompetence. The terms related to eInclusion in the section above identify certain aspects of eInclusion which are implicitly related to one another, but lead to different, separate developments and solutions as they seem to only consider one aspect at a time. All these aspects, however, – especially in their combination – are of great importance when trying to ensure eAccessibility.

3 eCompetence and its influence factors

We have reorganised and complemented the terms in section 2.3 in order to determine factors that a person's eCompetence depends upon. The result, a first version of the flower model of influence factors on eCompetence, is presented in figure 1. The person in the center is influenced by six factors: physical, psychological, and cognitive abilities, education, experience, and environmental factors. We interpret the first three of them as internal factors as they directly "come from" the person itself. The latter three are external factors related to the person's context and surroundings.

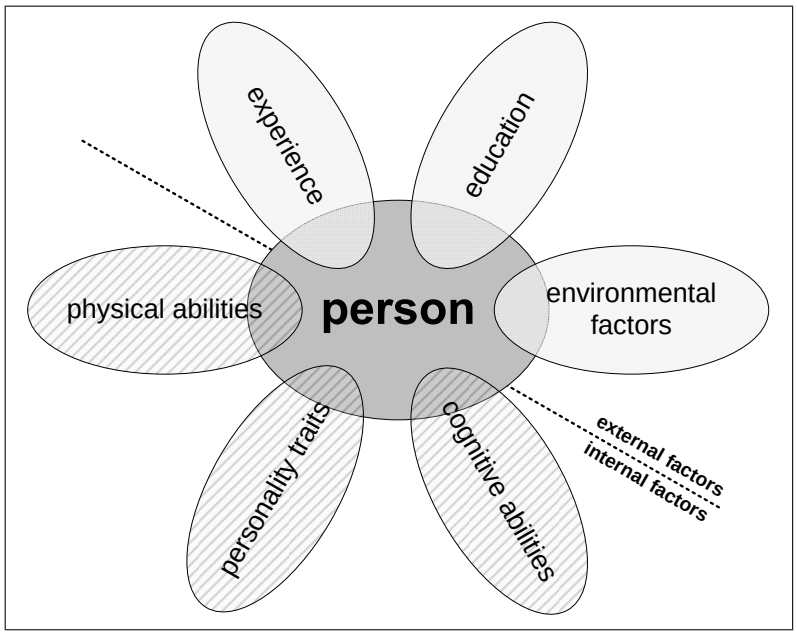

Figure 1: Factors influencing a person's eCompetence.

Physical abilities are related to how a person physically accesses and uses a computer. This includes different types of disabilities – motor difficulties, visual problems, hearing impairments. Depending on their disability, people might need special applications or devices to access ICT.

Cognitive abilities determine how well people can concentrate, how they process information, or derive knowledge and the like.

Personality traits such as the Big Five [4], Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism, have been found to influence information behaviour [7] and gaming [15]. We therefore consider them to be influence factors on eCompetence as well.

Education obviously influences eCompetence in terms of knowledge and skills acquired on using ICT. Comprehending e.g. underlying concepts facilitates understanding complex coherences.

Experience with ICT – presumably mostly positive experience – improves eCompontence in extending a person's mental models about ICT. But also non-ICT experience may be of use when ICT uses non-ICT metaphors.

Environmental factors contain the socio-cultural and geographical factors mentioned in section 2.3. The social and cultural situation of a person, as well as the environment the person lives in – urban

or rural, remote, and economically disadvantaged – can lead to unequal conditions in ICT access and therefore, in eCompetence.

The term 'age' in eAging mentioned in section 2.3 in the context of eInclusion does not appear among our influence factors as it is too imprecise with regard to a person's eCompetence. A person's biological age does not give any clue on how well this person gets along with ICTs. It rather depends on the combination of factors described above, on each person's individual development.

During our user study [11] we asked participants to explore an alternative way of interacting with a computer in a Wizard–of–Oz experiment: by using only speech. Most of our participants remained in their application-oriented mindset and used phrased commands for their interaction, no matter how old they were, or which physical deficiency they had. Their interaction behavior in our study was directly related to their experience (how they usually interact with their computer) and, in the case of those who actually experimented with speech interaction during the study and tried different approaches, to education.

Similar models to our flower model of influence factors on eCompetence have been elaborated in the past. Wilson [22] collected his *Intervening variables in information-seeking behaviour* from various sources. Those include personal characteristics, emotional, educational, demographic, social/interpersonal, environmental, and economic variables, as well as information source characteristics. Concluding his article he revises his own 1981 model and applies it to general information behaviour, including the following intervening variables to information behaviour: psychological, demographic, role-related or interpersonal, environmental variables and source characteristics.
Since Wilson's model is more general than our model on eCompetence, some of his influence factors such as the social/interpersonal variable concern persons as information sources.

The Canadian Model of Occupational Performance and Engagement (CMOP-E) depicts the dynamics between a person (affective, cognitive, and physical), occupation (Self-care, Productivity, and Leisure), and environment (physical, institutional, cultural, social) as well as spirituality. It serves as a means to describe a person's occupational performance where "Occupation refers to groups of activities and tasks of everyday life, named, organized, and given value and meaning by individuals and a culture. Occupation is everything people do to occupy themselves, including looking after themselves (self-care), enjoying life (leisure), and contributing to the social and economic fabric of their communities (productivity) [23]". The CMOP-E is used in Occupational Therapy in a context a lot broader than eCompetence. However, similarities between the CMOP-E and our flower model can be found.

Other models exist which describe what the term eCompetence comprises, but we are not aware of other models disclosing influence factors on a person's eCompetence.

4 Inclusive eLearning

eLearning in the sense of learning supported by electronic media offers numerous possiblities: People learn in a self-directed way along individual learning paths. They find themselves in the center of the learning process and profit from interactivity, from flexibility in terms of time and place of learning, from a variety of media presenting the content and from scalability, adaptation, and support. These aspects – if fully exploited – hold a huge potential for people with disabilities. "The real value of e-learning may therefore not be in serving people already well served by traditional training, but rather in making training available to people who find it difficult to participate in classroom training, or who choose not to [13]".

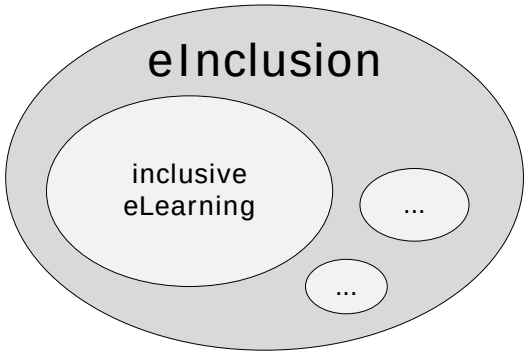

Figure 2: Inclusive eLearning as an area of eInclusion.

4.1 eInclusion in eLearning

We consider Inclusive eLearning to be an area of eInclusion, just like Inclusive eGovernment in section 2.3 or e.g. Inclusive Games. Its main goal is to best include everyone in eLearning, to best consider special/ individual needs when creating eLearning applications and settings (see also [1]).
Inclusive eLearning concerns two different scenarios:

1. General eLearning applications and general eLearning content need to be accessible to people with special needs via specific access methods and devices.
   This requirement addresses different layers of the eLearning product: the application itself as well as the content; in the case of web-based products also the webbrowser (on top of – or rather as the basis for – e.g. the learning management system (LMS) and the content). Typical barriers here are the same as in application programs and web content in general. Application and content need to be accessible to everyone via different target devices and different access modes (see eAccessibility and Web Accessibility).

2. Special applications and/or special content address special target groups, e.g. in the case of cognitive disabilities that require special pedagogical approaches.
   These cases will probably always require special solutions in terms of content preparation as well as in application design. However, similarities may occur among those solutions when addressing the same or similar target groups.

The problems occurring for (1) can be seen as general eInclusion problems, i.e. general eAccessibility issues, except maybe the accessibility of learning management systems as a special eLearning-related type of application software, while (2) is a special topic for Inclusive eLearning that is likely to require special solutions.

4.2 From special to individual solutions

When considering that there is neither “the typical blind computer user” nor “the typical computer user” in general, the flower model in figure 1 should be seen as – in computer science terms – a general class “person” with each individual computer user being an instance of that class. Each computer user can be described by his own individual combination of attributes in each of the six categories. Software should adapt to individual person instances, i.e. to individual users, rather then focussing on a single factor (e.g. visual impairment) at a time.
Such development would lead to a move from special to individual solutions, as already declared [19],

which should eventually lead to more usable software and a better user experience in general. To this end, the flower model could serve as a user/learner model that software adapts to.

5 Projects on eInclusion and Inclusive eLearning – An Overview

This section gives a short overview about projects in the field of *eInclusion* and *Inclusive eLearning*. As already said, eInclusion can be divided by different aspects. On the one hand it can be distinguished by the form of assistive technology which indirectly gives an indication to the target group. On the other hand it is possible to differentiate according to the domain (and the content) of the application, like *eLearning* or *eGovernment*.

Assistive Technologies are special (hardware or software) user interfaces which facilitate computer interaction. According to the kind of disability, different technologies are used: Speech Synthesis and Speech Recognition, Sign Language Synthesis, Haptic User Interfaces and Gesture Recognition. The development of these interfaces is regarded in the field of alternative user interfaces and multimodal interaction. As a matter of course they are not limited to the integration of disabled people but are also used to gain higher comfort. In the EMBASSI [6] project it is possible to control e.g. lamps with speech and gestures. The SMARTKOM [21] project also aimed at a multimodal control at home, with mobile devices and in the office. Another project is MAIKE [10] which aims at developing technologies for user assistance in smart environments like instrumented working environments and conference rooms with the help of speech recognition, mobile devices and intention analysis. In the SUE project [12] a screen reader for visually impaired people has been developed. All these interfaces relate to eInclusion in general as the interaction with the machine is one of the most important steps. Of course these aspects also apply to Inclusive eLearning, as this is a subset of eInclusion. The following list describes some selected eInclusion projects.

ÆGIS is an integrated project within the ICT programme of FP7, which tries to find out whether so called 3^{rd} generation access techniques will result in an approach (in the context of desktop applications, rich web applications and Java-based mobile devices) which is more accessible, more exploitable and deeply embeddable [16]. The target groups are: people with disabilities (blind and low-vision users, motor impaired users, cognitive impairedusers, hearing impaired users, speech impaired users) and developers of ICT applications.

ASK IT (Ambient Intelligence Systems of Agents for Knowledge Based and Integrated Services for Mobility Impaired People) is also a European Integrated Project. Its vision is to develop services based on Ambient Intelligence and Information and Communication Technologies that support people with different disabilities, e.g. to allow mobility impaired people to move independently, which increases the quality of life. Thus a secure economic and social inclusion [8] can be realised. The target groups are users with lower limb impairment, wheelchair users, upper limb impairment, upper body impairment, physiological impairment, psychological impairment, cognitive impairment, vision impairment, hearing impairment, communication producing and receiving difficulties.

Vital is an EU co-financed DFKI project aiming at fulfilling the needs of elderly people. Those often have difficulties to make use of information technology advances as they often require them to know how to use specific interfaces. In this project familiar devices like the TV are used as the main vehicle for the delivery of services to elderly users in home environments. A combination of automatic speech recognition, a remote control and the TV makes it easy for elderly users to

access audio books, tele-education, personal newspapers or a tourist audio guide[9]. The target group comprises elderly people (hard hearing, short sighting, slow responsiveness, difficulty to understand complex concepts, hard learning curve and difficulty to manage too many simultaneous tasks).

REACH112 is a project which improves access to emergency services for people with disabilities in the EU by real-time text conversation, with sign language, with lip reading, with voice or with any simultaneous combination of these modes[10]. The target group generally embraces all people with disabilities, but especially all people with hearing impairment.

The E-Inclusion Research Network develops audio- and video-processing related tools and methodologies for multimedia content producers in order to improve the multimedia experience for visually or hearing impaired people. This is realised by automating key features of the multimedia production and post-production processes[11]. The target group are visually or hearing impaired people.

Further european projects concerning the ageing society are *ElderGames*, *eSangathan* and *Mpower*. For a full list see Europe's Information Society Thematic Portal[12]. An overview of current projects in the area of eInclusion can also be found there[13]. The following list contains some projects in the much smaller field of Inclusive eLearning.

EU4All This project has the aim to design, implement and evaluate a framework for the accessible lifelong learning for mature age students and students with disabilities [3].

Australian Flexible Learning Framework The Australian Flexible Learning Framework[14] tries to increase the use of eLearning resources and technologies by young learners and people with disabilities. This should improve employment opportunities by the help of the *Disability and Mental Health Flexible Learning Toolbox* that uses tasks, activities, and problem solving methodologies to support the learner. The tasks and supporting resources consist of real-life situations which provide the learner with different ways to obtain the required knowledge and skills. This project targets learners with disabilities.

AGENT-DYSL This project makes use of a combination of speech and image recognition as well as semantic technologies in order to build an adaptive reading support system for children with dyslexia [14].

REPLAY The aim of the project REPLAY is to develop a gaming technology platform to provide young marginalised people showing an anti-social behaviour with a learning environment to facilitate their reintegration into society [2].

Inclusive eLearning scenarios imply several challenges. Adapting learning content to individual learners and their individual abilities is far from easy. In order to address this challenge, Santos and Boticario [17] developed recommendation models along with a multi-agent architecture to offer content suitable for the current user and course context.

[9] http://www.ist-vital.org/
[10] http://www.reach112.eu/view/en/project.html
[11] http://e-inclusion.crim.ca/
[12] http://ec.europa.eu/information_society/activities/einclusion/research/ageing/index_en.htm
[13] http://ec.europa.eu/information_society/activities/einclusion/research/projects/index_en.htm
[14] http://pre2009.flexiblelearning.net.au/flx/go/home/projects/2006/inclusive

Savidis, Grammenos and Stephanidis [1] present four inclusive eLearning applications that each address users with different abilities. They discuss design issues and efforts they faced in developing those applications coming to valuable conclusions regarding the design and implementation of e-learning platform and accessible game development.

In her work Gjedde presents a narrative framework for an augmented interactive learning environment [9]. The software uses assistive technology like augmentative functions and configurable navigation to engage learners with multiple functional deficits. The iterative development process involved teachers and learners which imposed a great challenge but also very valuable feedback for the developers.

Apart from technical realisations, the social and economical background also needs to be examined. The report on *Inclusive learning for all: why accessible e-learning makes business sense* [13] analyses how much of the potential of eLearning for disabled people has been realised so far and what are best practices for designing eLearning to maximise accessibility. The MEAC project[15] measures the progress of eAccessibility in Europe by country profiles providing an overview of relevant policies and levels of eAccessibility in 25 EU countries. The ICT & Aging Project study[16] that has been launched by the European Commission aimed at identifying and understanding the market barriers which currently hinder uptake of ICT for independent living and active ageing in Europe. The objective of the project AUXILIA[17] is to demonstrate the potential of most innovative inclusive methodologies and technologies.

In summary it can be said that there are many projects ongoing which deal with alternative user interfaces, eLearning, eInclusion and the like. The field of Inclusive eLearning, however, is quite small. It can for sure profit from joint efforts such as the workshop series on Inclusive eLearning, bringing together researchers and practitioners from related fields for discussions and advancements in Inclusive eLearning.

6 Conclusion

In this paper we have investiged the terms Universal Design, Design for All, Inclusive Desing, Universal Access, and eInclusion. We have defined Inclusive eLearning to be an area of eInclusion like Inclusive eGovernment or Inclusive Games.

Rearranging and completing the terms connected to eInclusion led to a first version of the flower model of influence factors on a person's eCompetence. This model aims at shifting from classifying users into "the blind", "the deaf", "the old", etc., from general, rigid statements towards understanding computer users as individuals with their own, individual combinations of attributes in the six fields of physical, psychological, and cognitive abilities, experience, education, and environmental factors. Application development should not aim at special target groups, disabilities, or environmental factors, but consider individuals with individual needs. The same applies to learners interacting with eLearning applications.

Looking at existing projects in eInclusion and Inclusive eLearning, it seems that eInclusion projects often try to address various disabilities and the Design for All approach, while projects in Inclusive eLearning target specific learning disabilities and conditions. The results are special solutions for specific needs, often for relatively small user groups.
Considering users/learners as individuals leads to more flexible solutions that may address larger user groups. One of the key requirements to this is awareness of individuality and individual needs, which is one thing the workshop series on Inclusive eLearning can help create.

[15] http://www.eaccessibility-progress.eu/
[16] http://www.ict-ageing.eu/
[17] http://auxilia.e-inclusionsite.org/theProject.php

The flower model proposed in this paper may be used as a basis for a user/learner model leading to individual (adaptive) solutions. The next steps will be to relate the different influence factors and combinations thereof to pedagogical approaches, specifying how certain abilities reflect in learning and interaction strategies, and how to adapt applications and content to individual learners. The result needs to be fairly adoptable by application developers and content providers in order to become good practice.

References

[1] Anthony Savidis, Dimitris Grammenos, and Constantine Stephanidis. Developing inclusive e-learning systems. *Universal Access in the Information Society*, 5(1):51–72, June 2006.

[2] Carment Cretu. Gaming Technology Platform for Social Reintegration of Marginalised Youth. In *Domestic Violence: between Stigmatisation, Social Acceptance and Therapeutic Intervention*, 2008.

[3] David Swallow, Helen Petrie, and Christopher Power. Understanding and Supporting the Needs of Educational Professionals Working with Students with Disabilities and Mature Age Students. In *Computers Helping People with Special Needs*, 2010.

[4] J. M. Digman. Personality structure: Emergence of the five-factor model. *Annual Review of Psychology*, 41(1):417–440, 1990.

[5] European Commission. BEING PART OF IT: European Research for an Inclusive Information Society. Luxembourg: Office for Official Publications of the European Communities, 2008. ISBN 978-92-79-08587-1.

[6] Yves Forkl, Bernd Ludwig, and Kerstin Bücher. Dialogue Management in the EMBASSI Realm. Using Description Logics to Reason about Ontology Concepts. In *Proceedings of IMC2000*, 2000.

[7] Jannica Heinström. Five personality dimensions and their influence on information behaviour. *Information Research*, 9(1):paper 165, 2003.

[8] Laura Pastor, María García, Luis Reigosa, Maria Fernanda Cabrera Umpierrez, Alexandros Mourouzis, and Brigitte Ringbauer. Nomad Devices Adaptation for Offering Computer Accessible Infomobility Services. In *Universal Access in Human-Computer Interaction. Ambient Interaction*, 2007.

[9] Lisa Gjedde. 1126 Current Developments in Technology-Assisted Education (2006) Story-based e-learning as a vehicle for inclusive education.

[10] Markus Berg, Nils Weber, Gernot Ruscher, and Sebastian Bader. MAIKE: Mobile Assistenzsysteme in intelligenten, kooperativen Räumen und Ensembles. In *5. Kongress für Multimediatechnik*, 2010. *(to appear)*.

[11] Markus Berg, Petra Gröber, and Martina Weicht. User Study: Talking to Computers. In *Proceedings of the 3rd Workshop on Inclusive eLearning*, 2010. to appear.

[12] Martina Weicht and Alke Martens. On the way to digital literacy for everyone: A user interface agent to assist (not only) blind computer users. In *Inclusive E-Learning: Special Needs and Special Solutions*, 2008.

[13] Chartered Institute of Personnel and Development. Inclusive learning for all: why accessible e-learning makes business sense. Technical report, CIPD, 2004.

[14] Paraskevi Tzouveli, Andreas Schmidt, Michael Schneider, Antonis Symvonis, and Stefanos Kollia. Adaptive Reading Assistance for the Inclusion of Learners with Dyslexia. In *IEEE Conference on Advanced Learning Technologies*, 2008.

[15] Patrick Felicia. Modelling players behaviours and learning strategies in video games. In *Proceedings of the ECGBL Conference*, 2009.

[16] Peter Korn, Evangelos Bekiaris, and Maria Gemou. Towards Open Access Accessibility Everywhere: The AEGIS Concept. In *Universal Access in Human-Computer Interaction. Addressing Diversity*, 2009.

[17] O.C Santos and J.G. Boticario. Intelligent Support for Inclusive eLearning. In *Web Intelligence and Intelligent Agent Technology*, 2008.

[18] Constantine Stephanidis. Towards universal access in the information society: Achievements and challenges. In *Paper presented at the Workshop on Universal Accessibility of Ubiquitous Computing: Providing for the Elderly*, Crete, 2001. ICS-FORTH (HCI Laboratory) Internal Report. Accessed August 2, 2010.

[19] Constantine Stephanidis. User interfaces for all: New perspectives into human-computer interaction. In *In C. Stephanidis (Ed.), User Interfaces for All - Concepts, Methods, and Tools (pp. 3-17). Mahwah, NJ: Lawrence Erlbaum Associates (ISBN*, pages 3–17, 2001.

[20] Constantine Stephanidis and Anthony Savidis. Universal access in the information society: Methods, tools, and interaction technologies. *Universal Access in the Information Society*, 1(1):40–55, June 2001.

[21] W. Wahlster. *SmartKom: Foundations of Multimodal Dialogue Systems*. Springer, 2006.

[22] T. D. Wilson. Information behaviour: An interdisciplinary perspective. *Information Processing & Management*, 33(4):551 – 572, 1997. web version at http://informationr.net/tdw/publ/infbehav/cont.html.

[23] Cynthia Zhang, Carly McCarthy, and Janet Craik. Students as translators for the Canadian Model of Occupational Performance and Engagement. *Occupational Therapy Now*, 10:3–5, May/June 2008.