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1 Executive summary

One of the main obstacles to widespread adoption of the “Design for All” approach in ICT industry is the lack of appropriate training material and support. Towards this end the DfA@eInclusion project organized and presented a workshop titled “Paths to support adoption of a Design for All approach in ICT industries” on September 24th – 25th in the premises of the Fraunhofer Institute for Applied Information Technology FIT in Germany. The purpose of the workshop was to gather together industry and other stakeholders to broadly discuss this topic. Representatives from large corporations as well as smaller organizations, academia, international standards organizations and end user advocate groups shared examples of what has worked and brainstormed to create a framework for developing a training structure to support the adoption of DfA by ICT industry. These lists of curriculum topics and training approaches will form the foundation for a CEN workshop agreement and White Paper, both of which should advance the movement towards design for all becoming the norm rather than the exception in ICT industries approach.

This document discussed the organization of the workshop, following this are the explications of several key concepts that the discussion was based upon and an analysis of the state of the art in industrial training (as well as academic approaches) compared with the results of the IDCnet project. Then follows a summary and analysis of the outcome of the presentations and brainstorming sessions. A list of initial topics presented to the discussion groups and the participants are added as an appendix.

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3 Design for All

This deliverable documents the activities of a workshop on training issues required by industries in adopting a "Design for All" approach. The workshop participants were drawn form industry, academia and standards organizations. The workshop was held at the campus of the Fraunhofer Institute for Applied Information Technology FIT, located in Sankt Augustin, Germany. Before discussing the outcomes of the workshop it is necessary to clarify some terminologies and scope issues. The following sections provide a working definition of key concepts and a brief discussion of similar challenges that industry has faced in the near past.

3.1 Defining DfA

From the beginning through the end of the workshop the definition of Design for All was brought up. There is no 'canonical' definition of Design for All. In fact there is no place that could issue such a definition that would be adhered to by all stakeholder groups: Industry, Academia, and Standards organizations (including legal standards), as well as user organizations. Here is a partial list of terms that are often used interchangeably, but some of the participants see them as having relevant different shades of meaning:

- Design for All
- Inclusive Design,
- Universal Design or Accessibility

Each part of the above phrases needs clarification, for instance what does 'all' mean? Does this mean design for as many as possible? What are the limits to the range of 'possible'? Clearly the answer will be the result of many tradeoffs and in the context of current technology. The size of possible may be quite different to the academic researcher and industrial designer. The concept is strongly context bound, and a deeper analysis of the concept in different contexts is needed. One of the challenges of this workpackage's white paper (D5.4) will be to come up with a definition of DfA that satisfies the groups of stakeholders.

Beyond terminology a set of interrelated questions also repeatedly came up:

- How do you define the relationship between accessibility (for elderly and persons with disabilities) and usability?
- Is accessibility an aspect or even a precondition for usability?
- Is usability an aspect of accessibility?
- What is the place of User Centred design in Design All?

Is there a useful hierarchy relating Usability and accessibility? ISO 9241-113 does define usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". Is accessibility only a measure of effective use of a system, or is it an attribute of all three aspects of the usability definition? Another challenge contained in the D5.4 deliverable will be to address these questions.

3.2 Defining the User

In this project the term user will refer to one of number of stakeholder groups. Stakeholder can be defined as member of a group having a stake or interest in the outcome of the project; this can also include persons affected by the project. A number of different stakeholder roles and grouping of stakeholders came to be defined in the breakout group process. The four primary stakeholder groups were:

- Industry
- Academia
- Standards organizations (including legislative standards)
- End-users and organisations representing them

Industry had many subdivisions of stakeholders, and thus many different stakeholder agendas with respect to DfA:

- Executive Manager
- Middle Manager
- Research and Development teams
- Software & Hardware Developer
- Designer
- Reviewer & Tester (QA)
- Marketing
- Communications
- Finance
- Human Resources (HR)
- External Stake holders i.e. Customers and end-users (consumer union)

Additionally each role may be quite different with respect to the size of the company: start-up, small to middle, and multinational. Similarly, for developers and designers sub-sub groups of existing and new employees, as well as internships, need to be considered as having very different needs in the process of DfA implementation. Each one of these groups may have agendas that conflict with each other. The process of solving the adoption of DfA problem is not simply an optimization process; the solution will be different in each corporate culture and is an example of a *wicked* class of problems [31], one of whose attributes is that the form of the problems resolution is determined by the process of solving the problem.

Academia has fewer subgroups, perhaps only shades of several types: research based, industry based, standards based, and various combinations of these three.

Standards organizations can be broken into three groups: legislative, standards, and advocacy groups. Advocacy groups may not seem to fit the groupings but if one thinks of them as an outside group providing prescriptive or proscriptive parameters to the DfA solution then they fit in with the other two.

3.3 Defining ‘requirements’

What does requirements in this case mean? The DoW says (pg 64):

> *Summarizing, this WP aims to:*
> - *Build guidelines for creating of e-accessibility ICT training courses and recommendations on conducting such courses.*
> - *Standardize such guidelines by starting the process of a CEN Workshop Agreement or similar mechanism, where all stakeholders, and in particular the ICT industry, are represented.*

This deliverable is charged with building a set of *user requirements in e-accessibility training materials for industry* (DoW pg 66). From the statements in the DoW above, this set of requirements can be broken down into the basic categories of the topic to be discussed:

A. What to teach
B. Who to teach
C. How /Where to teach
D. When (sequence) to teach

This workshop primarily addressed the critical items A and B, and touched topics C and D. 'A' requirements are defined as broad areas in section 6.1; 'B' requirements are discussed in the stakeholders section above and also in section 5.1 following.

3.4 Analogical situations

One useful approach to understanding the challenges and opportunities of a fundamental change in a corporate approach to key processes, for that is what a change to adopting a DfA approach is, might be to look at similar situations that have been encountered in the recent past. Three such events were brought up and discussed by the workshop participants: the 'total quality management (TQM)' and Manufacturing Requirements Planning (MRP) movements started in the 80's and the ISO9000 adoption movement of the 90's. While these three are all interrelated (particularly TQM and ISO9000), each presented different challenges that were not limited to the factory production floor but radiated out to all parts of the corporation. While it is beyond the scope of this deliverable to present these in detail, it is pertinent to point out several issues that may be very critical to the adoption of DfA. First is the agreement about what the larger goal that the movement addressed, in the case of TQM the change from "inspecting quality into the product" to eliminating the production of defective product; in the case of MRP the change was from ensuring ability satisfy customer demand by stockpiling parts and sub-assemblies to satisfying demand by flexible scheduling and just-in-time raw material delivery. The second is an agreed upon method of measuring success of the changeover. Both of these (and perhaps more) are challenges that the DfA movement has yet to solve. Other analogical paradigms that were brought up, with perhaps less analytical potential, were product safety and diversity training.

4 State of the art on training requirements in Design for ALL

The ICT market is changing so fast that ten years are considered as an eternity. It is essential for companies to be sensitive to changes and to be able to react quickly. Besides the highly publicized globalization of markets, they also have to take into account the ageing of the population, the technical advancements providing a big variety of devices on the market, and the increasing respect for the diversity of consumers and their needs.[1]

Until now, people with disabilities have relied on assistive technologies to access information and communication technologies (see http://www.abilityhub.com/ for an overview of these technologies). Most of these technologies are expensive and they are an additional cost on top of the mainstream products that everyone else uses. By applying Design for All to mainstream products and making them usable for the disabled and elderly, many additional costs may be avoided. However, there are a number of specially designed technologies (for example Braille output) which can probably not be replaced by mainstream products. Some people expect that, as more Designed for All mainstream products become available, the market for these specialized technologies will shrink [21]. Knut Nordby uses the usability pyramid as a metaphor to illustrate the role of Design for All [28] (see Figure 1).

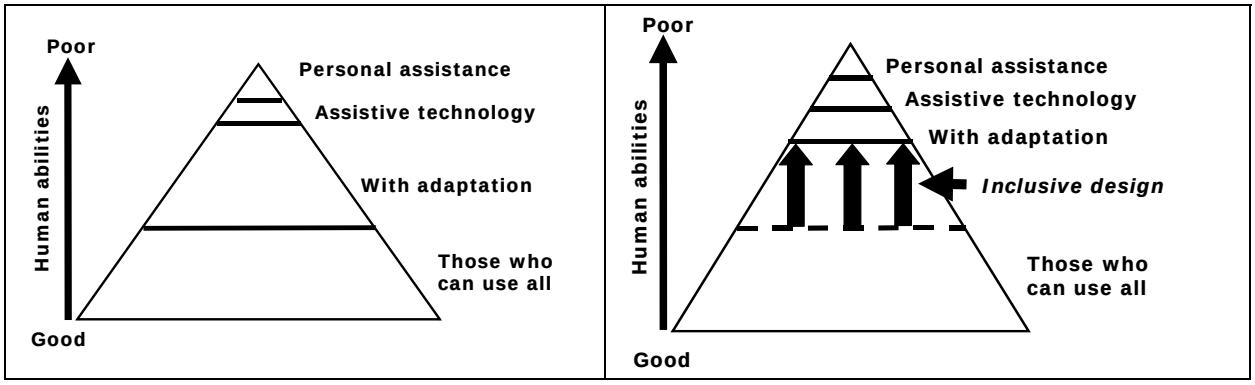

Figure 1 The Usability Pyramid and Inclusive Design

This pyramid represents all users of ICT products and services, with human abilities along the vertical axis, from good at the bottom to poor at the top. There is a wide base of users who can access all ICT products and services directly. Above that is a smaller section of users who can access products and services with some form of adaptation. Above this is a much smaller section of users who need some form of assistive technology. The small section at the top of the pyramid represents users who need personal assistance to access ICT products and services.

The main goal of Design for All is "to push the boundary between 'Those who can use all' and 'With adaptation' as far up as possible" [28]: The general public sees disability as an attribute of a person that may be either congenital or the result of ageing, a disease or an accident. This view is too static. As Poulson and Waddell have pointed out [30]:

> *…disability is situation-specific. Disability is not an attribute of the individual - it is the product of the interaction between the individual and their environment. For example, someone who uses a wheelchair may be 'disabled' amongst a group of individuals climbing a mountain but perfectly 'able' amongst that same group of*

[1] Other discussion of reasons for or advantages of Design for All can be found on http://www.design-for-all.info/16890449,16890459.xml.

> *individuals sitting round a table having a discussion. For someone with profound hearing loss the situation may be totally the reverse.* [30]

If we accept that disability is situation-specific, it becomes clear that Design for All does not only benefit "people with disabilities". Several examples from the built environment and transportation illustrate this point. Curb cuts, for example, do not only benefit people in wheelchairs, but also parents pushing prams, people with heavy luggage and roller-skaters. Low-floor buses help everyone to get on the bus faster, and make bus stops shorter. Related to this is the fact that many people who can benefit from Design for All, for example elderly computer users with limited vision, don't think of themselves as having a disability.

Many research projects identified three major obstacles to a broad implementation of Design for All[2]:

- Lack of awareness among users and suppliers;
- Technical feasibility; and
- Commercial viability.

4.1 Attitude - Lack of Awareness

While lack of awareness is no doubt an obstacle, research by the I~Design project[3] suggests something more serious. Keates, Lebbon and Clarkson found a number of misconceptions concerning Design for All that may serve as arguments against it or that may lead to design that favours one disability while causing new problems for other disabilities [10].

The I~Design project wanted to examine the prevailing industry attitudes and identify the barriers to the uptake of Universal Design. In October 1999 the project was launched with a workshop with the aim of assessing the level of industry awareness of the needs of the disabled and elderly communities and their openness to Design for All. There were over 150 participants with representatives from a wide range of companies, including: British Telecom, Virgin Atlantic Airways, Omron Corporation, NatWest Bank and Tesco [10].

> *The initial stance of most of the industrial participants was that they were willing to implement Universal Design providing that it was either easy to do, or that a consultancy would do it for them, and providing that it did not increase the cost of the product or service. There did not appear to be widespread acceptance of the need for Universal Design training programs for designers or an appreciation of the potential increased market of more accessible products. The concept of 'undue burden' appeared to be anything that would cost more than the able-bodied version.*
>
> *Stereotyping was also a very common problem. The misconception that designing for universal accessibility was a code-word for designing for the elderly and disabled only, and that this represented designing for the institutionalized. There was little understanding of aging as a gradual process that creeps up on everyone. One transport company had claimed to have made most of their buses more accessible by including spaces for wheelchairs on the lower deck of their double-decker buses. This was perpetuating the image of someone who is physically impaired being a wheelchair user. A walking-stick user, however, commented that this measure actually made the buses less accessible to her and others like her, who outnumber the wheelchair users, because there were fewer seats downstairs, making it necessary for her to climb to the narrow, twisting stairs to the upper deck.*

[2] http://www.education.edean.org
[3] http://www-edc.eng.cam.ac.uk/idesign

> *However, encouragingly, there were also success stories to report. Tesco have redesigned their shopping trolleys to be shallower and more manoeuvrable. OXO have developed the highly acclaimed GoodGrips range of kitchen accessories. The success of these products shows that there is a demand for more accessible items, but industry is being slow to respond. The common thread behind these is that the drive has been top down, from the senior management, rather than from the bottom up, driven by designer knowledge and training. This suggests that the best way to encourage the uptake of Universal Design may be to persuade senior management of the need for it.*
>
> *However, awareness of the need to design for increased accessibility is not necessarily a guarantee that the goal will be achieved. In Rehabilitation Robotics, a field dedicated to design for the disabled, products have often failed because of lack of usability and accessibility. It is essential that designers are adequately equipped to implement Universal Design. In the second half of the I~Design workshop a number of design consultancies ran break-out sessions on designing products for the physically impaired. Those that were successful used empathic, user-centred approaches, such as design by story-telling and body-storming. Less successful were the groups who tried to design without any attempt at empathy with the end users.*

Other key results from the workshop included the importance of removing stigma from products designed to be more accessible. This is where both Tesco and OXO appear to have had the most success. By treating their designs as being simply more accessible mainstream products, rather than specifically developed for individual user populations, they have developed products that are genuinely more inclusive. [10]

The I~Design project also identified some common issues regarding inclusive design in the United Kingdom and the U.S. [7]:

- The perception that the adoption and implementation of inclusive design differs between large and small companies.
- Time and cost were regarded as the biggest constraints on adopting inclusive design.
- Most companies, whether large or small, preferred to refer to specialist organisations for support and information.
- Exemplars of good design were sought after by design practitioners as sources of inspiration.

There were also differences between the U.S. and the U.K. In the U.S., legislation was considered the most important factor which resulted in consideration of the needs of people with disabilities. However in the U.K. legislation was seen only as providing a basic platform. The study also identified a number of strategies to facilitate the adoption and successful practice of inclusive design, for example, better awareness of inclusive design, and better design tools, including more comprehensive statistical and market data.

4.1.1 Legislation

Industry acts in a playing field that has certain rules and those rules are set by society and the markets. Some playing fields are more regulated others less regulated – the telecoms playing field is very much regulated.

Although legislation has a very strong awareness-raising effect, it is not always regarded as a good incentive. Ronald Milliman [25] conducted a study on the accessibility of web sites in the private sector and asked web designers and web masters: “What incentives would work best for achieving

compliance to accessibility standards?" The possible choices and their respective rates of response show that legal penalties are the weakest incentive of those that were suggested (see Table 1).

Table 1: Incentives for achieving compliance to accessibility standards [25]

Incentive	Number	Percentage
Making non-compliance punishable by a substantial legal penalty	45	9.91
Only when it can be shown that compliance will result in noticeably larger website traffic	247	54.41
A government matching fund to help offset the costs	96	21.15
More education on "accessibility issues and how to make sites compliant"	66	14.54

Perrett cites an example of a company that "has an ambitious and developing strategy of service provision for disabled customers, but felt that the timing was perhaps not right, citing, amongst other things, uncertainty about the nature and extent of the legislative regime that will emerge from the Communications Bill" [29]. Although his article is about telecoms and the example refers to a mobile supplier and the Communications Bill, it is conceivable that similar attitudes exist in the web domain and with laws that are relevant to web accessibility.

4.1.2 Technical Feasibility

Developers and designers are generally willing to take on a challenge, but there are few testimonials of their views on the technical feasibility of Design for All. The questionnaire used in Milliman's study did not even ask whether technical barriers were the cause of inaccessible web sites.

During the IDCnet[26, 38] in Helsinki, Klaus-Peter Wegge of Siemens said that in Germany, blind persons often use cell phones from Siemens (because of the sound cues), whereas persons with other visual impairments tend to use cell phones from Nokia (because of the readability of the screens). On the other hand, David Dzumba's presentation at the COST 219bis Conference in December 2001 shows that Nokia has made considerable efforts to improve the accessibility of a number of products [8].

Sometimes, the guidelines or standards which must be implemented are considered too complex. For example, there are web masters who find the Web Content Accessibility Guidelines "too complex, too detailed and not accessible enough for their knowledge of the subject" [14]. Related to this problem is the difference between the tools and procedures for creating and maintaining web sites and those for removing accessibility barriers. There are many tools that enable authors and web developers to create and maintain web pages without knowledge of the underlying languages, but evaluation and repair tools are not as user friendly as authoring tools, the repair process cannot be automated and the tools require an adequate knowledge of the technical aspects [14].

In the ICT field, companies are often dependent on other companies or communities that they cannot influence. For example, software manufacturers cannot influence the operating system (which is Microsoft Windows in most cases). Some have looked into the possibilities of Open Source software, because it is possible to influence it to some extent.

4.1.3 Commercial Viability

Design-for-All advocates sometimes portray design-for-all as cost-free, whereas many people in the industry see it as having extra costs in design resources that are hard to justify, both internally in the struggle for resources and externally in the market.

This contradiction suggests several issues: industry wants to know the real cost of design-for-all and find accurate figures on market size (figures are now available on different locations for different types of disabilities instead of one location for all the info). Perrett, by contrast, claims that companies

have got statistics and information about the numbers and spending power of disabled people and about the numbers of disabled people who use telecoms [25].

> *One thing that will drive industry to accept anything, whether it is Design for All or whatever, is money. There are two aspects to this. You have to try to bring it home to industry, looking at disability, for instance, that if they do it, they will make money. That is the business case. You also have to bring home to them the fact that if they don't do it, it will cost them money. And it will cost them money in two ways. One, in lost market share to the companies that actually do it and two, in terms of payment for litigation, as that must come. [24]*
>
> *There are two driving forces. Legislation is one and profit is another. It is not very interesting for a company to know that 10% or 20% of the population are disabled. They need more precise figures about a specific market such as 17–24 year olds, single or married, etc. They are focussed very precisely on these groups where they think they can earn a lot of money. One has to apply that philosophy also to the group of disabled people and then one will find that, unfortunately, the groups are not that large and the companies have to consider whether it is worthwhile from the economic point of view to make an investment, to conquer that little share. You have to educate people in the company, the marketing personnel, the people in the shops and everyone; it is a huge extra cost to do this. [24]*

Chapter 2 of Joe Clark's *Building Accessible Websites* discusses a number of myths about accessibility, including its costs. He admits that accessibility is expensive.

> *Yes, it is – for a large site and if you do it after the fact. Retrofitting always costs more, even at the level of adding a dimmer switch in your house. In all other cases, access may cost, but it is not necessarily expensive. In compensation, you gain a new audience.[4]*

Clark refers to the Sydney Olympics case, in which the Sydney Organizing Committee for the Olympic Games claimed that adding simple access features to its database-generated web pages would cost 2.8 million Australian Dollars. This figure is much higher than the tens of thousands of extra expenditures estimated by the expert witnesses. Building accessibility into the project from the beginning would have added 2% to the cost, according to the experts. However, many commercial web sites were not designed with accessibility in mind and will need retrofitting, unless the web masters of those sites postpone adding access features until the next big redesign. Clark points out that for every retrofitted page, the developer must evaluate the page's condition and make informed decisions to fix problems. This process is not easy and cannot be automated, but accessibility advocates are often hesitant to admit this [5]

On the other hand, Clark points out that developers do many other things (custom-coding scripts, designing graphics and rollovers, creating animated GIFs, etcetera) without asking who benefits from it, but just because the client decided they were worth the money. "If you're willing to go to all that trouble, what's wrong with incorporating access techniques into your development cycle?"[5]

In spite of the importance of commercial viability in the discussions quoted above, there have been cases where this issue was not a barrier. For example, when one of the departments of Nokia in the U.S.A. wanted to start its first accessibility initiative, top management was in favour of this, although there was no expectation of significant return-on-investment [9]
Some of the preceding paragraphs are about web accessibility, but it is reasonable to extrapolate some of the arguments to Design for All in general.

In the project IDCnet efforts were made to define the optimal graduate profile for Design for All in ICT-related jobs, concluding that the task has to take into account several factors:

1. The needs of the industry, which are partly dictated by legislation and partly by market forces.
2. Future technologies, in order to “predict” the knowledge and skills that will be needed by students who will graduate in an information society characterised by ambient intelligence.

4.2 Existing Curricula Recommendations: Methods and Practices

In [39] there are four questions that should be considered in curriculum design: what is to be learnt, why it is to be learnt, how it is to be learnt, and when it is to be learnt.

- What is to be learnt? Training in industry focuses more on knowledge than skills or attitudes, but skills and attitudes are very important during recruitment. Curriculum designers may want to strike a different balance between knowledge and skills. Also, technology changes very rapidly, so it is important "to enable the learner to possess the groundwork to update his knowledge … rather than to transfer a specific body of knowledge and techniques" [39].
- Why is it to be learnt? Industry needs are only one aspect of this question. However, it may be interesting to consider why industry does not cover certain subjects in its own "curricula".
- How and when is it to be learnt? These questions are the territory of educational experts. However, the way in which certain knowledge sets and skills are put to use in industry can provide some ideas on how certain subjects may be taught and how the employee’s achievement may be assessed.

Or, from another perspective:

- what is to be learnt – knowledge, skills and behaviours (outcomes)
- why it is to be learnt – rationale and underlying philosophy
- how it is to be learnt – process (this includes debating the teaching to support, the way learning will be demonstrated and achievement assessed)
- When it is to be learnt – structure of the learning process.

Curriculum design and development is the subject of much collaborative research. Recent years have seen much activity within this area. The reasons for this are several, amongst them:

- The breaking down of boundaries between disciplines and the emergence of new disciplines, resulting in requirements for learning that are based in inter-disciplinarity and multi-disciplinarity
- The needs of industry for more employees who demonstrate flexibility, the ability to think critically, to undertake complex problem solving activities, with well developed communication and interpersonal skills, particularly since much design and development work now takes place within the framework of multidisciplinary teams.
- In the European context, and not only, the need to have equivalences of learning and knowledge acquisition experiences, so that accreditation gained at one institution is valid in other geographical areas.

- In the context of continuous learning, it is seen as more important for learning at university or on professional development courses to enable the learner to possess the groundwork to update his knowledge as and when needed, rather than transfer a specific body of knowledge and techniques, that may become quickly obsolete.

Put another way, course and curriculum design is changing. “There are increasing social and economic pressures on higher education to generate a wider range of knowledge, skills and attitudes for coping with the demands of our 'supercomplex age'. The current pace of technological and social change is impelling teachers to think in terms of educating students not for today's problems but for those of tomorrow." [23].

The work described in this deliverable concerns mainly the first point, identifying what is to be learnt. Other educational experts take a finer grained view of the process of designing the curriculum, approaching the design at the course level. At this level the tasks seen are to:

1. establish need and demand for the course
2. establish student characteristics,
3. determine content
4. set goals and objectives
5. choose teaching and assessment methods
6. implement, evaluate and adjust components as necessary

In our case, it is not possible at this stage to follow this sequence, because we are not at the level of granularity of designing a course. However, the list should be retained for the other important lessons it offers, for instance, the need to establish employee’s characteristics.

The methodology followed by Dfa@einclusion has broadly been that followed by the IEEE/ACM joint activities on curricula recommendations [12], namely to gather together a large number of experts to define a body of knowledge, to divide it into areas, and then assign a group of experts to each area to further distinguish topics within these areas. This methodology has been followed for several reasons. First is that the aim of this WP is not to produce complete curricula, but recommendations. Therefore this methodology was more appropriate than other curriculum design methodologies which concentrate on creating a complete curriculum as an independent entity. This approach is not appropriate for Design for All since it cannot be described as a distinct discipline, and therefore it cannot be taught in isolation from other subjects. Indeed, Design for All can be useful introduced into many subject specialities, from Architecture to Marketing. Further this methodology enables flexibility; topics can be added or discarded as technology advances, as well as a structure for all efforts to be mapped to, aiding curriculum designers to acquire an overall picture of the subject without needing to be experts in every area.

A review of the contemporary literature on curriculum development indicates that much of the existing work either: (a) focuses on the development of educational resources; or (b) identifies desirable features of development methods without providing any practical guidance [15]. For this reason, the next section discusses what has been done as funded work on curriculum development within the EU, and measures the work plan and strategy of DfA@eInclusion against it, in order to better comprehend the scope of activities within this work package.

4.2.1 Curriculum Development activities in Europe

The EU, through its DG on Education and Culture and its programmes Socrates and Erasmus has funded a large number of curriculum development projects [11]. These projects support three types of activities in the area of curricula jointly developed by universities.

- Projects for the *joint development of "study programmes"* at any level, from undergraduate to intermediate, advanced ("Masters") and Ph.D. level;
- Projects for the *joint development of European "modules"*, such as specialised language modules; courses on history, society, culture, politics of other European countries; aspects on European integration or comparative aspects relating to the content of a given discipline;
- Projects for the *implementation and dissemination of curriculum development projects* which have completed their development phase.

A report [22] evaluating the progress and results of ongoing and finished projects in the period 1996—1998 found the following characteristics, which are reported below and compared with the aims and achievements of Dfa@einclusion (in *italics*):.

- Most projects concentrated on the formal aspects of curriculum i.e. content and objectives, rather than its operational aspects e.g. teaching and learning aspects, or grouping of students, or evaluation methods, etc. - *Dfa@einclusion is also in accord with these trends, the first step in any endeavour at curriculum recommendations is to determine the body of knowledge to be learned.*
- The two most popular objectives for curriculum development activities and thematic networks funded by the DG Educational and Culture were “Providing quality education and/or specialised training for students” and “Meeting the needs of industry or other external groups”. Less frequent objectives (5% to 8% of projects) included ‘supporting the development of particular subject areas’, and ‘informing policy-making.’ - *Here DfA@eInclusion differs from these curriculum development projects in that while it did seek to meet the needs of industry, there are no other external groups, such as formal associations from which it can seek approval or accreditation. Nor does DfA@eInclusion want to view Design for All as specialised education. Rather it sees that knowledge about Design for All should be ‘infiltrated’ into various disciplines and curricula. Dfa@einclusion however, does place great store on informing policy making, because it is important in this time of changing curricula to make sure that the re-engineered curricula include Design for All.*
- With regard to the means used to reach the objectives, nearly all the projects mentioned the development of courses, modules, and teaching materials. Two other means were frequently mentioned: “working together to identify common elements, comparing educational programmes or material, exchanging ideas and pooling expertise” (around 20% of projects) and “including recent research findings in teaching”. *With regard to “identifying common elements and comparing programmes”, “exchanging expertise and including recent research findings”, this has been the work of this work package so far.*
- Considering the content and methods, a high percentage of projects (66%) reported having an interdisciplinary focus. This may be related to the fact that much cutting-edge research is now being carried out in interdisciplinary areas and that the labour market expresses the need for fewer single subject specialists and for more people who are capable of working in interdisciplinary fields. *.As noted above and elsewhere, Design for All is in essence a horizontal subject, which needs to be incorporated into design sectors of all types, everywhere where human ‘users’ are involved.*
- Problems led to readjustment of objectives: In two cases (13%), the development of joint (core) curriculum was replaced by the development of a broader “body of knowledge”. One of the greatest problems was the difficulty of integrating the courses or curricula into the existing study programmes. Institutional, national, and disciplinary barriers were mentioned by the project leaders as contributing factors.

4.2.2 The relationship between curriculum and current thinking on teaching methods, strategies, learning philosophies

As has been seen there are different beliefs, values and ideologies in relation to course design. Traditional curriculum design has tended to focus on the transmission of discrete pieces of information, -frequently facts and formulas,-from instructor to learner. This is because the information is considered important in its own right. However, it is well understood by educationalists that information takes on more value when it compliments a need for information. Traditional curriculum design does not reflect this reality, and therefore it often does not provide students with opportunities to develop the kinds of critical thinking skills and problem-solving abilities that are central to thinking and learning [20]. Furthermore, traditional curriculum design does not include opportunities to build the kinds of personal and collaborative skills that support learning.

With regard to teaching and learning strategies, curricula most likely to be found at Company level follow pedagogical models that range from traditional or discipline based, through performance or system based, to cognitive, personal relevance/experiental and socially critical [35]. In contrast, current thinking encourages having a project or problem based curriculum, and having intended course outcomes that encourage analysis, synthesis and application. The rationale is that the action of doing, coupled with reflection on this action, will help towards the generation of new and meaningful learning experiences.

At the same time a whole host of teaching and learning strategies are proposed, such as

- Deep, surface, and strategic approaches to learning
- Personal learning styles
- Life long learning and self directed learning
- Generic objectives and transferable skills
- Small group (tutorials) and large group teaching
- The role of practicals and demonstrators/teaching assistants
- Flexible learning/flexible delivery, including teaching with new technologies

Based of the work in IDCnet, the main import for DfA@eInclusion work package on identifying core knowledge and skill sets, was to help to define these sets by setting up learning outcomes for each category of knowledge that has been defined in our taxonomy. From these recommendations for a training curricula in industry can come the creation of exemplary training courses.

4.2.3 What are learning outcomes?

As previously stated, in the older teacher-centred approach, teaching was generally seen to be about the transmission of knowledge. As a result, the focus was on what the teacher did, and course objectives were expressed in terms of the content which the teacher would transmit. In the newer learner-centred approach, however, the focus is on what the learner does. The goals of course of learning are nowadays usually expressed in terms of how the learner will be changed as a result of the course. The statements describing the change in learner's behaviour which should result from taking the course are known as 'intended learning outcomes'. Teaching then becomes a series of strategies which are devised in order to help students achieve these outcomes. Learning outcomes are considered to be of primary importance in developing topics or subjects, because they point to the content of the subject, to the appropriate ways of facilitating teaching and learning a subject, and to the appropriate ways of assessing the subject. Thus in a 'bottom up' way, the learning outcomes help to shape and structure the content.

Although often used interchangeably, there is a difference between learning outcomes and learning objectives having to do with the level of specificity [6]. Objectives are strict and, usually, very detailed behaviourist statements which specify *exactly* the action that is to be assessed. Outcomes tend to be more holistic descriptors of the overall goal..Thus to be consistent with current pedagogical thinking, the emphasis should be on learning and not on teaching. Design for All educators should think in terms of what they want the employee to learn, rather than what they will teach. Thus each category of knowledge should be associated with goals and learning outcomes.

In addition, the emphasis on the learning experience, as opposed to the teaching method, allows for a constructivist approach to learning, whereby the learners are led to gain knowledge in a structured way that enables them to view learning as a cumulative experience, acquiring knowledge that is open ended, and enabling them to build upon existing knowledge as the field moves on. This is done in two ways. Firstly the skills of team working and interpersonal communication identified as necessary for the practice of Design for All are added as a separate category on the general, horizontal level; that is, these skills apply to all sectors of design. Secondly, the identification of learning outcomes, will help to lead the implementers of these results to incorporate Design for All in a way that reflects the important pedagogic trends of:

- Constructivism: pondering, exploring, discovering, explaining
- Socratic questioning and dialogue: type and areas of questioning, brainstorming, concept mapping, teacher as facilitator
- Collaborative/Cooperative working relationships: research, discovery based learning, problem based learning, partnership development
- Critical thinking: single focus area, deeper probing

4.3 Existing Core Knowledge Sets and Skills

4.3.1 The taxonomy of core knowledge sets and skills (IDCnet)

This section presents the knowledge sets and skills that were derived from the strategies outlined in the IDCnet project[4], and structured as a taxonomy formed of 2 main categories, and 9 subcategories, as shown in the table below. Each set corresponds to a subcategory within the taxonomy, and each subcategory may have many topics, with corresponding examples in it.

The categories and subcategories within the taxonomy are meant to be broad enough to accommodate changes in content over time, although certain topics and examples that fall in each subcategory are time dependent. Not withstand this, the nature of this domain is that it is closely linked to advances in technology and the content of the categories will need continual updating. However, and consistent with other methodologies for shaping curricula recommendations, the basic subcategories for the body of knowledge should remain the same over time.

The purpose of the taxonomy was to classify information concerned with DfA so that prospective instructors/ curriculum designers can see at a glance what types of information are involved. At the same time the classification categories need to be wide enough to be applicable in many different areas and forward looking enough to provide for new information to be classified in the existing schema rather than continually creating new subcategories. The taxonomy can be used as a basis for teaching pilots, but not all subcategories may be presented to students, this depends on other factors such as length of course, or module, background of students, perceived needs for expertise, etc. The

[4] http://idcnet.info/

taxonomy provides the framework for both drawing up curricula recommendations and organising content for a Design for All course.

Table 2. Taxonomy of Design for All knowledge sets and skills

Design for All: Core Knowledge Sets and Skills
Category: General: applicable to all design disciplines Subcategories: 1. Design for All Awareness. What is Design for All? 2. Why Design for All: ethical considerations, compliance with legislation, commercial potential 3. Recommendations: Principles, Guidelines, Standards, Best Practice, etc. 4. Interpersonal Skills: effective communication in multidisciplinary design teams
Category: Information and Communications Technologies (ICT) Sector Subcategories: 1. Accessible content 2. Accessible input and output 3. New paradigms of Interaction, Applications and Research 4. User centred design 5. Application Domains and Research

The material in these categories is applicable to 'breadth versus depth of knowledge' approaches, i.e. determining what the learner has to be aware of, as opposed to what the student is expected to be able to know well and be able to apply. It is up to individual institutions/ instructors, or in the case of self study, the students themselves, to decide what level of competency in what particular topics is required. The whole range of subcategories could be used, making the basis of a course. It is particularly suitable for design students, provided they have already had tuition in topics concerned with design processes. A more flexible approach would be to take topics from the sets or categories in a 'mix and match' style to blend into on going courses. This could be done at a module level, or even blended into units, for instance teaching how to code for Braille output, alongside coding for other types of output.

Some sets may diminish in importance, or even fade away over time. This would certainly be the hope for the 'Awareness' and the 'Why Design for All' categories; as the philosophy of Design for all becomes established as part of traditional design there would be no longer a necessity to emphasise or rationalise it. However, if the slowness of related areas like human factors and HCI is any indication, we shall need these categories for some time to come.

4.3.2 Category: General: applicable to all design disciplines

The four subcategories of the general category are, as the category implies, relevant to all design disciplines, including architecture, transport, product design, etc. Within each subcategory, the content could be tailored to specific sectors. Although, of course, for teaching purposes, it is often very useful to make analogies with work from other sectors, for example, the architectural environment, to illustrate a point, e.g. "An inaccessible web site is like an inaccessible building, it doesn't matter how nice it is inside, if I can't get in." In addition, as boundaries are being broken down between disciplines, it becomes increasingly important for designers of all disciplines to at least be aware of what is happening in other areas.

4.3.2.1 Awareness of Design for All

This knowledge category serves most often as an introduction to Design for All. By various means students are encouraged to think of users in a wider category than just mirror images of themselves, to understand how barriers are unintentionally put up when user needs are not sufficiently understood.
One of the most valuable tools used [32] here is to invite guest (disabled) speakers who can describe first hand the problems they face, and perhaps demonstrate some of the technologies that allow them to access ICTs. Failing "live" guests, there are some very instructive short videos available for instructional use, such as those produced by WEBAIM [41], where a blind and a deaf user each demonstrate some of the problems they face, and the tools they use. Also the IDCnet project has made its Web site different digital versions of the video "Web sites that Work" available[5].

The point communicated here is that Design for All is not a euphemism for "Design for the Disabled", but design rather for a diversity of users, with a range of abilities and different capabilities. So while practical exercises can be used, like empathic modelling [27,18] to simulate some of the effects of aging, or disability, simulation exercises can also be used to show that 'handicapping situations', such as holding a baby while trying to send an SMS on an unfamiliar mobile phone, can result in failure to accomplish the tasks successfully.

Finally, another strategy is to encourage learners to observe examples of bad design [34]. This can be used as a measure of the success of the awareness exercises: observing how students set about the task of reappraising the world around them, beginning to see obstacles, or possible obstacles, where previously they had not noticed any, or not given any thought to the matter.

Learning outcomes:
Learners are made aware of problems faced by users in various contexts, e.g. access to built environment, products and services, and information sources (especially the Web). Students understand that Design for All, does not mean one universal solution, ('one size fits all') but the inclusion of accommodations that serve many situations and users, i.e. both those with disabilities and those in handicapping situations. Students are weaned from thinking that the only way to implement Design for All is to design for different categories of user, and to focus on capabilities. For example, a device should be capable of withstanding tremor, whether it be caused by the user having Parkinsons or the user using the device on a moving train.

4.3.2.2 Why Design for All? Ethical, legal and commercial considerations

Under this knowledge subcategory learners are introduced to three complementary rationales for Design for All, as given in the subtitle above.

- As part of **ethical** considerations, students learn about the history of Human Rights, from the 1948 Declaration of Human Rights, through to the Disability movements of the 1960s, to understand, the move from segregation to integration, from specialised solutions to Design for all, that is, inclusive solutions and equal opportunities for all. This is set in the context of emerging world views, where there is a shift away from an emphasis on the individual to a more communal, collaborative approach in which social justice is at least as important as individual well being.
- As part of **legal** considerations, students learn about various pieces of legislation, how they have come about, their impact, and what is probable to happen in the future. It is very important in this area to emphasise both the global nature of the legislation, with laws in force in the US, Canada, Australia, Japan and Europe, as well as local efforts in countries the students are interested in. When dealing with ICT, and e-commerce, globalisation may mean

[5] http://idcnet.info/wai_video

that products and services produced in one country, but available worldwide, may have to conform to different laws. It is also helpful to underline the connection between legislation and standards, with the latter often being the basis for the former. The whole debate underlining the "carrot and stick" approach of current legislation, as well as the problem of legislation being prescriptive can also be part of this content.

- As part of **commercial** considerations, students are introduced to the commercial benefit of Design for All, and various supporting arguments, such as demographics and the ageing population, the problem of retro-fitting design, etc. An understanding of the notion of corporate social responsibility is also invoked. In today's environment, corporate social responsibility profiles have increasingly become fundamental in building trust and reputation with the clients and consumers companies do business with. In this context, the experience of 'closed doors' can have a negative influence on the way people perceive even the most reliable companies and the strongest brands. Thus companies that display a commitment to Design for All do so because they believe it means a reduced risk of action under disability discrimination legislation, a better corporate image and a greater access to potential markets. Examples of the commercial success of products designed for all, for instance, the OXO range, are also useful to illustrate the points made here.

Learning outcomes:
Learners are made aware of the rationales for Design for All. This helps them to understand the importance of the topic from several angles, and is good motivation. At the same time it enables them to marshal arguments in its favour, and justify its existence on several levels.

4.3.2.3 Recommendations

This knowledge subcategory is used flexibly for topics such as Principles, Guidelines, Standards, Recommendations, and Specifications that have a bearing on Design for All. In addition, the legislation that uses standards as their basis can also be referred to. As can be expected, there are many, many examples, and a few are given below for illustrative purposes, mostly concentrating on those that have a bearing on ICT

- **Principles**: The most prominent example are *the seven principles of universal design* from the Centre for Universal Design, North Carolina State University [37]. The interesting thing about these was that they were developed by a multidisciplinary team of architects, product designers, engineers and environmental design researchers, to guide a wide range of design disciplines including environments, products, and communications.

- **Standards**:

    - De jure: ISO DTS 16071: Guidance on accessibility for human-computer interfaces (2000). This draft technical specification (derived from ANSI HFS 200) [19] provides guidelines and recommendations for the design of systems and software that will enable users with disabilities greater accessibility to computer systems (with or without assistive technology). It includes low vision users, hearing impaired users, deaf users, users with physical and cognitive impairments, and the elderly. It is not yet a full standard.

    - De facto: W3C's WAI guidelines [40] are the clearest example of de facto standards. As a way to get to grips with the Web content accessibility guidelines, Automated accessibility checking tools which refer the user back to the recommendations, help to reinforce the use of them and provide a way of motivating students to study the recommendations.

- **Guidelines**: from companies, such as Microsoft, Sun, IBM, etc. [16] characteristically these are written in a style that is easier to read than formal standards, they expect their readership to be software engineers, programmers, etc needing easy to pick up practical guidance. Since

they also want to promote their company's products, the guidance they provide is not always applicable to other products

- **Legal requirements**: There are countries like the USA that require the implementation of their own recommendations (see e.g., Section 508[33]). Other countries, like Germany, adapt and modify slightly existing Guidelines like those of WAI (see e.g., German Accessibility decree: Verordnung zur Schaffung barrierefreier Informationstechnik nach dem Behindertengleichstellungsgesetz, Barrierefreie Informationstechnik-Verordnung BITV [13]).
- **Recommendations**: The CEN/CENELEC Guide 6 [3] The purpose of these sorts of documents is to be used by a specific audience, that of standards developers, to guide them on how to include Design for All in standards. However, for a short document of 30 pages, it contains very useful information, such as definitions, and helps get an overview of the range of Design for all, by looking at the areas it can impact on, following the normal format of standards, (e.g. the tables in clause 7).
- **Specifications:** These are normally lower level descriptions, which are fairly prescriptive, used by engineers, such as the widths and heights of objects, or for software engineering, where they represent the translation of user needs into machine and code requirements. As an example, the Accessibility specifications for the Learner Information Profile, from IMS [17] provide information models, use cases, XML bindings, etc

Learning outcomes:
Learners are made aware that such bodies of knowledge exist, and where to find them. They should be encouraged to search for such work and consult them as a first step, whenever they are set a task.
Students may need to be shown how to make use of these resources. It may be necessary to demonstrate the need for interpretation from the general and abstract to the particular, so that they can use and implement them in specific contexts. Several other points about the use of recommendations may also need to be made. The 'jargon' of each type of recommendation is a consideration, as is the difference between a formal standard, backed by an accredited standards body, compared with an informal set of "rules of thumb". The terms "recommendations", "specifications' and "guidelines" are used in various ways. Students need to understand what can be seen as authoritative and validated, and what is less so. Currency is another issue. A de jure standard may become outdated quicker than a de facto one, simply because the process for formal standards tends to be lengthy, while technical standards, because of the advances in technology are liable to become outdated, so the most recent version should be sought.
As learners are engaged on learning about, or carrying out tasks in, for instance, accessible content, the guidelines referring to this could be invoked. Given the interest of industry in standards and legislation, for students engaged in a course of continuing professional development, this subcategory will probably be of more interest than to the typical undergraduate. Most in-house training for corporate professionals is done using the guidelines provided by their own companies. The issue of interoperability and to open source work needs to be seen in the context of design for all, that is not locking people into one supplier.

4.3.2.4 Interpersonal Skills for Teamwork and Communication

This category is slightly different from the preceding ones because it centres on skills rather than on knowledge. These are mainly behavioural skills such as team work, communication skills, information representation, information retrieval, etc. and are recognised as being very important to interdisciplinary ICT based work practice [3]. There are several studies, both in teaching literature and in business practice noting the increasing importance of "soft skills".

However, many of the techniques used in these soft skills to not explicitly pay any attention to Design for All, although they could be very useful. To describe some of these techniques, it is necessary to refer to the actual teaching strategies that are the most useful way to give students the opportunity to learn these skills, e.g. organising team projects, presentations and critical evaluations (critiques).

Students must be encouraged to make sure that they adhere to the principles of design for all, even in their presentation material. For instance, they are asked to think more carefully about colour and layout of the slides, imagining that they must cater for those who are visually impaired or are sitting too far back in the auditorium to be able to see. By the same token, if they use diagrams or images, they should refer to them, briefly describing them.

They should take care to face their audience and enunciate clearly, this is important for lip readers, for signers, but also to people listening to a language that is not their mother tongue, as well as to those who reinforce their understanding with facial gestures and body language. They should maintain coordination between what is projected visually and what they are saying. Other ways students may experiment is with using tools that read aloud slides (primarily for use by presenters with a vocal impediment, used by one student recovering from an operation and needing to minimise the use of her voice). Other materials, like videos, should ideally be captioned. At the very least, they need to be explained and described by the presenter.

Paying attention to their communication style in the sense of really thinking about the actual and potential needs of their audience, helps students generally with these soft skills. For instance, they scan the audience to see if there are any obvious problems in terms of lighting and acoustics, they make sure not to stand in front of the projector, or obscure it during their presentation, etc.

Other techniques include those for dealing with critiques. When a question is asked from the floor the question should be repeated for the benefit of the whole audience. This should be standard practice, but even more necessary if the questioner has a speech defect, or bad command of the language, that may impede other listeners understanding.

Besides presentation materials, students can be encouraged to submit their written work in digital formats that allows it to be made accessible to different modalities, for instance in easily convertible code.

Finally, within a work context these skills can be used to good effect to help to convince colleagues and superiors of the importance of including Design for All.

Learning outcomes:
Learners are made aware of the existence of these skills, their importance to the workplace, and to Design for All, and that they should themselves make sure of good DfA practice.

4.3.3 Category: Information and Communications Technologies (ICT) Sector

4.3.3.1 Accessible content: knowledge about documents and multimedia

As its label implies, this subcategory refers to ways of ensuring the that 'content', mostly the type of e-content found on information and interactive Web sites, is accessible to all. This category is perhaps the one most often used for courses on web accessibility, which uses the WAI guidelines as their basis. However, there is other information and knowledge to do with accessible content that is also very useful. For instance there are several sources of information to be found in various communication studies dealing with literacy, with dyslexia, with how people read on screen, as opposed to on paper, that are all also useful.

Topics can include:

- Making content understandable in the sense of legibility and ease of comprehension. That is, for text, writing clearly and simply, using summaries, etc., and providing text equivalents for non text information. For other media, making sure that media equivalents, usually captions for audio material, and audio descriptions for visual material (images, graphs, videos, etc) are

available. There are also other techniques, for simplifying the message of content, from using different colours, to small sketches. As with all Design for All, it is important not to focus on one user group, and exclude others.

- Making content accessible in the sense of structuring (multimedia) documents, by using metadata, style sheets, headings, and other presentation techniques, etc.
- Making content accessible in the sense of content management and use: easing navigation and interaction by being consistent throughout the content, and, as far as possible, ensuring predictable responses to user actions

From this subcategory, the material can be studied at the theoretical level, understanding perception and comprehension of different types of content, including findings from literary analysis to cinematography, and also at the practical "how to" level. It can apply to students who are Web designers with training in information and communication design, or web designers whose background is in pure computer science. Topics and their related objectives can become more specific, for instance, learning how to code for accessibility using different technologies The next deliverable, on the teaching pilots, will report on several ways of teaching this topics from this subcategory, such as a practical exercise in captioning a video, using SMIL, coding for Braille output, using automatic checkers, etc.

Learning outcomes:
Learners develop the ability to understand when content is problematic and why. They learn about current methods and techniques to produce accessible content, or to convert content. Depending upon type of student/ course, they develop to varying degrees the ability to create or aid in creating accessible content/ convert or aid in converting content.

4.3.3.2 Accessible interaction: input and output

This subcategory is subtitled input and output to help to explicate it. It is defined as the hardware and software embodiment of interaction. As assistive technologies, many of these devices are unknown to students. Yet as part of everyday device functionality, they accept features on their mobile phones like vibrating alerts and flashing lights, or a whole range of remote controlled devices. All these were originally belong to specialist technology, now all mainstream. How users make use of these alternatives provide insight into human abilities and inspiration for use in products designed for the majority

Topics here would include:

- Typology of different types of devices. Knowledge about assistive and adaptive devices that enable alternative input and output, e.g. speech synthesizers, screen reader software, screen magnifiers, alternative keyboards, etc., as well as different types of software, browsers and operating systems that allow manipulation of the content, etc. Knowing something about how these technologies work, both helps students to understand why content must be accessible to them, and also to avoid some of the common sense mistakes, that come if guidelines are followed without knowledge of the reasoning behind the recommendation. For instance, the layout of the web page that is not correctly structured for the user to tab through it. Students, having had experience of these technologies, are better able to appreciate that there are still problems with the use of these technologies. As a random example, speech synthesizers can still be very difficult to understand, and can make "mistakes" if they are presented with text that is an abbreviation, or in a foreign language (it will try to pronounce them as ordinary words in the language it is set up for).
- Knowledge about different types of modalities: speech, haptics, gesture, sketch, pointing, scanning, word prediction, voice input bio-sensors, etc. When we talk of multimodal interaction, we do not always appreciate that some of these at present more unusual input modes may soon become our habitual way of interacting with certain devices and services. Each modality may both include and exclude users. Thus a combination of modalities, or a

choice between a combination is offered, helps design for All. The downsides of this are the technical problems of bandwidth and synchronisation of the data streams.

- Knowledge about different bandwidths, device capabilities, etc. At the lower end of the technical spectrum, it is important to remember that accessibility also refers to things like how much bandwidth there is available. Unless these factors are taken into account, accessibility will be violated, waiting for a download of a SMIL file, or expecting to read a web page on a mobile phone screen.

Learning outcomes:
Learners are introduced to a range of different input and output modalities, devices that support them, and technical considerations. As with other categories, depending upon the specific course objectives and the background of the students, the material can range from "knowledgeable about" to "knowing how to"—that is, competent to talk about these topics; understanding at a general level how they function; to being able to actually develop and/or working on developments based upon them. In each case, the input and output is accessible in so far as it helps greater numbers of people to interact with the products and systems.

4.3.3.3 New paradigms of interaction

This subcategory was created as a 'catch all' for the work that is mostly in research state currently, but within the next five years —the typical time span of an undergraduate+master's university education— could breakthrough into mainstream development.

It is an important subcategory to have because it introduces students to the leading edge research in the area, research that often helps to keep Design for All on the agenda in Universities. Topics that can be distinguished are affective and social computing, a range of smart computing applications, such as smart homes, wearable computing (clothes and accessories) in vehicle telematic systems, pervasive and mobile computing, ambient intelligence, etc. These topics do not always incorporate a Design for All dimension, but many have their roots in inclusive design, such as smart homes for independent living, wearable computing to monitor vital life signs in infants at risk, and Fiat's in-car telematic systems research aimed at elderly users.

Another possible example is that of Digital TV. At the present time, there is much debate on digital TV, and its potential use as a web access device for interactive services. The thinking is that it will help to include users who are presently excluded because of economic reasons, or because they are not computer literate, or both. It is being spoken of as a tool for e-inclusion, the first steps are being taken by CENELEC [3] to try to ensure interoperability of the systems, the debate about what it might mean to users has just begun.

Learning outcomes:
Learners become familiar with the emerging paradigms, understanding how they have evolved from current work. Further specialisation depends upon both the background of the students, and degree of emergence of the paradigm. In each case, students must be encouraged to view these developments through the "lens" of Design for All, to discourage new technology being developed that is exclusive.

4.3.3.4 User centred design

This category is the one into which go all the human, user, usability/accessibility philosophies, methodologies, techniques that apply to requirements and evaluation phases of design, etc. Many of these are routinely taught as part of HCI courses, but as they are currently used they do not always include diversity in users and situations.

This means that some methodologies will not be suitable for some users, and others will need some rethinking to make them so. Special accommodations that have to be made when including a diversity

of users in the user-centred design lifecycle relate to practical issues about how to deal with disabled/elderly users. For instance, how to elicit rating scales from very elderly people, how to do a concurrent or retrospective verbal protocol with a blind person (in the first instance, if they are using speech synthesis, the design of the elicitation should ensure that the subjects don't talk over the speech; in the second instance, all interaction needs to be described to the subjects, which is not very easy, nor productive). Some users cannot be considered for verbal protocols because of difficulties with cognitive or physiological disorders that prevent them responding.

Some of the problems relate to the nature of the methodologies themselves: for some time past, one of the prevailing methods of doing comparative user studies was to group subjects according to user characteristics – such as novice /experienced users. However, for design for all, it is not useful to think in dichotomies, young/old, disabled/non disabled users. Instead there is a continuum of abilities on various dimensions. Over focusing on one disability (the blind) might lead to design that favours one disability while causing new problems for other disabilities.

Another important issue in using user-centred design with disabled and elderly people is the evidence of very strong "demand characteristics" -a phenomenon well known in psychological research-, where subjects give designers what they think they want to hear. Techniques that can get round such problems need to be devised or different methods used. It is also necessary to be sensitive to the unstated needs of users. There are many examples past and present of devices that fulfil technical requirements with the functionality that was needed, but are so displeasing aesthetically, or worse, stigmatise their owners, to the point that they will choose not to use them. Obtrusive hearing aids, and the loop, can be cited as examples.

What distinguishes Design for All from human-centred design is that students have to put more effort into understanding users needs, transcending naive assumptions about users needs and capabilities. For instance, when asked, most students felt that the deaf community has no problem with text, and would be adequately compensated with systems that provided them text equivalents. They did not appreciate that this is the case mostly for those who went deaf later in life, and that for those who are born deaf, or are deaf from an early age, the chances are that their schooling will have enabled them to attain reading skills that are not much beyond elementary school level. Assumptions about user abilities need to be supported, or disproved. To aid in this task there are many sources that describe the functional aspects of various impairments and disabilities [36].

Learning outcomes:
Learners are made aware of the work in this area, the methods and tools available, and are alerted to the fact that some accommodations need to be made, and workarounds found, when a wide diversity of user capabilities is being put at the centre of the design process. The benefits of this approach are that the design concepts will be stressed to the limit, at an early stage, allowing the design team to rethink misconceptions and parts of the design they had taken for granted.

4.3.3.5 Application Domains and Research

This label can refer to ‘application domains’, and separately to research issues and challenges that go with them, or it can view these two activities as related, dependent upon the case.
This subcategory has a wealth of domains, such as public access to information, authoring environments, health monitoring, and leisure activities, (online games) etc. An application domain of much concern at the moment is that of eGovernment, and with understanding that ‘traditional’ government services will eventually be phased out it is important that every one has access to these services, and that the services themselves are accessible and usable.

Learning outcomes:
Studying Design for All in a specific application domain within the ICT sector offers a means to help students move from abstract to focused examples of use. Domains of application may be used as the

basis for students to do project work. This allows them to consolidate knowledge acquired from other subcategories of the taxonomy.

4.3.4 Overall instructional goals and learning outcomes

As a further guide to the content of Design for All curricula, the following overall instructional goals ware offered. Educators can use a variety of topics, combined in ways that suit them, to meet these goals. The goals themselves are based upon what appears in current taught courses as objectives, and what was expressed in various ways (either in presentations, discussion of presentations, or brainstorming sessions) by the participants at the workshop.

Learners who have followed courses on Design for All should be able to:

- Work as part of a team to develop and deliver executable artefacts.
- Understand the importance of determining client needs.
- Know how to use various techniques and methods to capture user requirements, not just in how they might relate to the product or service to be developed, but also in terms of their needs and abilities, their wants, desires and habits in general.
- Be able to translate information and observation into user requirements with the help of other professionals, in the context of a multidisciplinary team and translating them to software requirements.
- Be able to help reconcile conflicting objectives, finding acceptable compromises within limitations of cost, time, knowledge, existing systems, and organizations.
- Help to design appropriate solutions in one or more application domains using approaches that integrate ethical, social, legal, and economic concerns.
- Understand and be able to apply current principles, recommendations, standards, as well as techniques that are part of the Design for All body of knowledge in design, development, implementation and verification activities.
- Negotiate, work effectively, provide leadership where necessary, and communicate well with stakeholders in a typical design development environment.
- Be able to add to their knowledge base about Design for All as new models, techniques, and technologies emerge.

Industry Needs

When discussing industry needs with regard to Design for All (or accessibility), the first problem is that there is little awareness of "needs" in countries or sectors that have no regulation regarding accessibility or the discrimination of people with disabilities. Companies in sectors where relevant legislation is in place are more sensitive to Design for All and tend to adopt it as part of their regulatory and stakeholder strategies. Further it must be kept in mind that the material in this section was primarily gathered in the context of academic training and what this part of the DfA@eInclusion project is aimed at producing guidelines and recommendations for training taking place within industry.

5 Workshop

5.1 Workshop participants

The workshop participants consisted of three groups:

- Representatives from ICT industry – 13 participants
- Members of the DfA@eInclusion consortium – 22 Participants
- A representative the CEN
- A representative of the European commission

The industries represented ranged from small start-ups and middle sized entities (Bank of Ireland, Iskratel) to industry giants (SAP, IBM. Nokia, British Telecom) to DfA consultants and professional advocates (Centre for Excellence in Universal Design, Designed for All Ltd, The Royal Society for the encouragement of Arts, Manufactures & Commerce (RSA)) The participants came from a range of EU member-states: Belgium, The Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lietuva, Malta, Norway, Slovakia, Slovenia, Sweden, and the United Kingdom. A list of participants is Annex B of this deliverable.

5.2 Workshop agenda

After a brief introduction, several presentations were made of examples of initial or successfully completed conversion to a Design for All approach. The topics for initial discussion (see Annex A) were divided up into two groups and participants were randomly assigned to one of the two breakout groups, each with a set of topics / questions to stat the process. Each group had a coordinator (mostly to keep track of time and take notes) and a facilitator (to keep the discussion focused) at the end of day one and after the final breakout group on the second day, the facilitator summarized the work done in the breakout groups.

5.3 Success Stories

The workshops goal was contextualized by the presentation of several success stories of implemented DfA approaches. Carlos Velasco began with a discussion of imergo®'s Web Compliance Framework[6], commercialised worldwide by RedDot Solutions AG. In discussing the push vs. pull approach to market design for all products to the industry he presented the legal requirements as a push mechanism and the *long tail* [1] theory of Internet marketing as an example of pull. There are a growing number of legal constrains that can force the implementation of a DfA approach for product creation. Along with and supporting the DfA approach is the need for evaluation tools to assure that the accessibility design goals have been met. He presented the success story about marketing the imergo® framework by RedDot to the international market and the integration into their content management system products, which established accessibility in their content creation process.

He presented the long tail perspective on the marketing plans for product design. Put simply, *long tail* describes the phenomenon, initially observed on web sales sites, that the Pareto's 80/20 law may not apply electronic transactions; that the lower 80% of sales items may account for 40% or more of sales (in contrast to the expected 20%). This may be a consequence of switching from atoms to bits, where it is as easy to 'stock' books that sale rarely as best sellers, to use Amazon.com as an example and all those low sellers add up in sales to 40% or more of the total sales of items. This means that a stronger economic argument can be made for adopting a DfA approach.

[6] http://imergo.com/

SAP's presentation emphasised the involvement of the end user in the process, from initial field research to test cases to development design and final product. Some companies (like SAP and NOKIA) have specialised knowledge (like DfA) in specialized groups that are brought in at stages in the design process to ensure that the programmers and designers have the right tools for the task and that the DfA approach is taken. They also have annual meetings to distribute up-to-date knowledge and best practices across all stakeholders. SAP regularly has a kick-off workshop for everyone that, among other things, that provides a venue where the accessibility people can show designers how to approach DfA. The workshop brings together experts from standards, evaluation, and technology, even the top-level management. In these annual meetings the accessibility experts talk about accessibility, and discuss the reasons behind a DfA approach.

IBM was presented as a company that has a mature accessibility / DfA implementation; part of this maturity includes small course for programmers and developers. The IBM representative also pointed out that top down support for inclusive design makes DfA possible. British Telecom presented their long history of user centred design, going back top the days of central office switchboards. British Telecom approached training in DfA usually through involvement in projects, which provided education of product management. She emphasised that what industry wants is concrete guidelines, checklists and examples – ***not*** more reams of information. At British Telecom the term customer centric design is used rather than of inclusive design but both mean basically the same thing. They done this on the basis that all they do as a business is designed around the customer and they (the customer) should be involved at all stages of the product development process. Additionally they feel that it was more inclusive as a term giving less emphasis on 'disability' which people may see as a niche market. British Telecom has a user accessibility panel of its own employees.

6 Workshop results

The workshop results are presented her in two forms: a table of required trainings and a short narrative of relevant issues that came up in the process of developing and clarifying the details of the table. The table can be seen as a guide to Who to teach, however the topics to be covered are defined very broadly and work needs to be done to make the topics more specific. The following outcomes, which can be looked at as a beginning to a training needs specification, were largely due to the strong and committed interaction of group members, guided by the facilitator. It is also noteworthy that the workshop reached lively interaction between different enough stakeholder groups, from academia to industry from a relatively wide variety of fields (see the participants list annex).

6.1 Training requirements table

Emerging from the consideration of the set of topics (see annex) was the table below(Table 3). It represents a first approximation of a list of who should be trained in what to implement a DfA corporate approach. The three levels of training is a rough guide to how much the workshop participants felt each role should have knowledge of DfA.

Table 3 DfA Training Requirements

Actors → / Topics ↓	Manager		Software & Hardware Developer	Designer	Reviewer & Tester (QA)	Marketing & Commun-ications	HR
	Executive	Middle					
Consumer groups	F	M	D	D	D	M	F
UI[7]	F	M	D	M	M	F	F
Backend technologies	F	M	D	D	D	F	F
Web Applications	F	F	D	D	D	F	F
User centric design	F	M	D	D	D	M	F
Evaluation issues	F	F	D	D	D	F	n/a
AT and state of the art	F	F	M	D	D	F	F
New paradigms for interaction (smart homes clothes cars…)	F	F	M	M	F	F	n/a
Best Practices[8]	M	M	D	D	D	D	n/a
Standardization[2]	F	F	D	D	D	F	n/a
Business Case[2]	M	D	F	F	F	D	n/a
Privacy and Ethics[2]	D	M	F	M	D	D	F
Legal Issues[2]	M	M	F	F	F	M	D

Legend (training type): F = Fact (overview) ; M = Middle ; D = Detailed (deep, practitioner level) N/A = not applicable to this group

Listed as significant stakeholders in the discussions but not having identified the depth of training needed were Sales, Customers (Consumer Union), and Finance

Table 4, below, provides examples of the topics raised in the breakout groups and listed in table 3, above.

[7] UI (User Interface) was changed from the original GUI (Graphical User Interface) to accommodate ICT applications like embedded systems that do not necessarily provide a window/pointer/widget set of affordances for interaction

[8] This set was discussed by one of the breakout groups but not the other (the 'odd' group)

Table 4 - Examples of Topics

Topics	Examples
User groups	Advocate groups for persons with various disabilities, consumer unions, user associations
UI	Windowing interfaces (GUI), assistive technology based user interfaces, hardware controls (e.g. PDA)
Backend technologies	SOAP, AJAX, databases, operating systems, networks, web servers
Web Application	Browsers, Web Services, web based scripting languages (i.e. JavaScript)
User centric design	CHI (computer human interaction) training and formalism, ethnographic based design and evaluation, user modelling, device modelling, focus groups
Evaluation issues	Usability labs, evaluation of systems in place, accessibility suites
AT and state of the art	Assistive technology conferences (CSUN, RESNA, AAATE), Journals & ACM conferences (ASSETS)
New paradigms	Design for All, Universal Design, SOA, Mobile devices, UbiComp
Best Practices	Team based design, task based design, model-view-controller framework
Standardization	ISO, IEEE, IEC standards bodies, W3C, CEN
Business Case	Long tail theory, marketing analysis
Privacy and Ethics	EU's Directive 97/66/EC and Directive 2002/58/EC
Legal Issues	EU mandates, BITV, USA 508,

The various stakeholder groups identified have been discussed in section 3.2 above. It should be noted that the difference in granularity will in some cases describe a difference not only between content but in approach to the content. For example in the topic UI (user interfaces), the knowledge that mangers need to have regarding the different kinds of user affordances and information display (e.g. their mere existence) is different in both scope/scale and kind from knowledge about UI needed for testers (i.e. expected detailed behaviour of various kinds of controls). Drilling down a bit more, one of the breakout groups brought up the fact that middle managers need to know enough to constrain actions but the CEO level has to know only the existence (facts) of UI elements.

As an initial validation of the list the workshop produced, table 5 below, shows the equivalence of the topics produced in the workshop and the taxonomy form the IDCnet project. It may be an interesting exercise to try and implement the missing taxonomical elements for IDCnet in further DfA@eInclusion workshop.

Table 5 - Workshop Topics and IDCnet Taxonomy Correlates

Workshop Topics	IDCnet category / subcategory
Consumer groups	General /Design for All Awareness. What is Design for All?
UI	ICT Sector / Accessible input and output
Backend technologies	N/A
Web Applications	ICT Sector / Accessible content
User centric design	ICT Sector / User Centred Design
Evaluation issues	• ICT Sector / User Centred Design • General /Recommendations: Principles, Guidelines, Standards, Best Practice
AT and state of the art	• ICT Sector / New paradigms of Interaction, Applications and Research • General / Design for All Awareness. What is Design for All?
New paradigms for interaction	ICT Sector / New paradigms of Interaction, Applications and Research
Best Practices	General / Recommendations: Principles, Guidelines, Standards, Best Practice, etc.
Standardization	General /Recommendations: Principles, Guidelines, Standards, Best Practice, etc.
Business Case	ICT Sector / Application Domains and Research
Privacy and Ethics	General / Why Design for All: ethical considerations, compliance with legislation, commercial potential
Legal Issues	General / Why Design for All: ethical considerations, compliance with legislation, commercial potential

Also pertinent to the discussion of the last two aspects of training (How /Where to teach and When (sequence) to teach) were the following observations:

- Nokia has one year of in-house training for new hires
- Even within a stakeholder group deep knowledge does not need to be held in every member of a group, it can be spread across the group so that the group at a whole has all the knowledge needed to accomplish the task in a DfA manner.
- SAP's perspective is that it was not just adding DfA training, but they changed the structure of the design team by adding an accessibility team member to the process – so it's not just changing by adding training it's also changing the structure of the design team.
- SAP sees it as being refreshed every year or ongoing i.e. this is not a one time thing it's ongoing
- Who is ultimately responsible for DfA is determined by the corporate organization and culture
- Consumer groups need not be external - IBM has internal use groups
- Computer based training packages for all identified role's should be created
- The course length for the awareness level (i.e. F or Fact (overview) level of training) should be about 30 minutes for every package an example has been created by British Telecom.
- The approach of the training packages could be like those at the site: http://w3schools.com
- Add functionalities that can be adapted to user needs; this content personalization approach will account for future technologies that will not have devices anymore but "interaction" with the user.
- Stress user involvement of users in the development cycle during the training
- Curriculum recommendations should consider future technology development.
- Action planning should be part of a training course/workshop, so people go home with something concrete, i.e. what DfA means in their project
- Training in interdisciplinary teams, not a single role (unless deep knowledge is conveyed, e.g. for programmers)
- Training materials should deliver information in text, graphic, and video formats to account for hidden disabilities of the audience.

Other topics which emerged in discussion were more orthogonal to the training process, but nevertheless pertinent:

- How do you measure DfA compliance?
- How do you tell when the DfA conversion has successfully finished?
- The different agendas (as well as scope and scale) of academia and industry's perspective of DfA
- Issues of certification of DfA

6.2 A note about motivation

A reoccurring topic, that is beyond the scope of this deliverable, was that of motivation to start and properly conclude the transition to a DfA based design approach. Two avenues of thought came out of the groups when the discussion returned to this topic. First was the impossibility of doing this transition without the support and active involvement of top management. Second was exploring the possibilities of push and pull motivation (or carrot – seeking the positive and stick – avoiding the negative) towards DfA.

It was noted by all the presenters of successful DfA design integration that critical to the process was top management's active involvement in the process, be it in the form of an evangelist for DfA or in

the form of a explicit re-formulation of corporate direction and commitment. Further it was pointed out that this commitment must not be only to start the process but to provide the motivation and resources to continue it.
The other point, positive and negative motivation to transition to a DfA approach, was also discussed in some detail. Carlos Velasco presented the *long tail* approach to evaluating the possible marketing gains in DfA, legislative mandates were mentioned as well.

Table 6, below, summarized the kinds of knowledge needed to initialise and properly continue the DfA process, apart for the training materials themselves.

Table 6 Adoption Motivation Matrix

Actors →	Manager		Software & Hardware Developer	Designer	Reviewer & tester
Topics ↓	Executive	Middle			
Legislation, standards	F	M	D	D	D
Market demand and business opportunities	M	M	D*	D	D
Social responsibility	F	M	D	D	D
Sustainability	F+	F	F	F	F

Legend (training type): F = Fact (overview) ; M = Middle ; D = Detailed (deep, practitioner level)

7 Conclusions

The October workshop was the first step towards fulfilling the objective of this WP5, which is to support the uptake of DfA within the ICT industry in Europe by making suitable training materials ready by industry adoption. This will be implemented by both the development of exemplary materials, and with the preparation of standardisation activities like for instance, a CEN Workshop Agreement. This first step has delimited the rough areas that training is applicable and the level of training appropriate to various roles in the industrial enterprise. Based on these results and the feedback from the participants to this document the next step will be to host a workshop, within the context of creating exemplary training materials and eventually resulting in a *CEN workshop agreement*.

The CEN workshop agreement is an international standard like document that can be used to guide in the creation if individually tailored training programmes appropriate to a specific organisation and industry. The advantage of a CEN workshop over other international standards organizations is the relative speed of the process while still involving a range of stakeholders in a structured process. The CEN workshop process entails several steps: The creation of a proposals for the workshop, development with the CEN organization of a 'business plan' for the specific workshop project, a meeting to start the workshop process with interested stakeholders, adoption of the resultant documents thru consensus, and finally the publishing of a CEN workshop agreement. The procedure requires a chair and after initial interest is confirmed, a representative of CEN will assist in the process. A requirement of the structured process to reach a CEN Workshop Agreement is that a CEN Member (a national standards body) is funded to take the secretariat of that Workshop. This funding needs to be provided by sponsor organizations or by the Workshop participants. This process needs to be self funded (i.e. there are no outside funding opportunities that CEN provides).

The first step in this process, after approval of the se notes by the network of concerned stakeholders (the core of which are the participants to the October workshop of which these are the notes), and from that basis creating a set of exemplary training materials for industry on e-accessibility. The task will support the development of an exemplary course for industry training, to be delivered as DfA@eInclusion Task 5.3 - *Exemplary training module on eAccessibility for industry training.* The next step will be to work with the collected members of the networks in gathering these materials.

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Annex A – The workshop topics

24.9.07

Discussion Points for Creating Exemplary Training Materials for Industry on E-Accessibility

1. What to teach
   - 1.1. Develop a list of the specific categories of courses that would constitute a DfA curriculum. You could arrange or generate the list by topics. Some examples might be:
     - GUI design
     - WebServices
     - User centric design
     - Evaluation issues
     - AT and state of the art
     - New paradigms of interaction such as smart applications: smart homes, clothes, cars.
   - 1.2. Generate or arrange a DfA course list by the attributes that such courses might have examples might include:
     - Compulsory / Optional
     - How evaluated
     - How was the module or course taught?
     - How class work done
     - Length of the module
     - From which departments or disciplines are the employees?
   - 1.3. The subjects in a curriculum will be guided by legal concerns as well as based on existing and proposed standards and guidelines. Examples of these are:
     - Standards: ISO
     - Laws: 508, BITV, EU273, EU283, US telecom legislation
     - Guide lines: WCAG

     Develop a comprehensive list and describe their qualities.
   - 1.4. The motivation for providing a DfA curriculum may come from legislation. Which laws (508, BITV, EU273, EU283, US telecom legislation) and how do they affect course design and offerings. How can your industry have greater awareness of disability legislation?
   - 1.5. The costs of DfA needed to be established and verified; rationalized integrated marketing needed to be considered by industry. How does the need for this affect DfA curriculum design considerations?
   - 1.6. How to create courses that increase involvement and understanding of user groups and social context. Social awareness should be created and taught to employees. How to increase user involvement both for the course and program perspective. How to listen to all players within a community.
   - 1.7. Similarly, Designers need to practice in real circumstances and understand fully the concept of DfA – how to embody this in curriculum?
   - 1.8. Should there should be greater focus on open source, non-commercial type of developments e.g. Linux. Motivations might include the fact that patents made products more expensive.
   - 1.9. Curriculum is not driven only by technical and legal requirements; marketing provides much of the motivation. How to produce a curriculum that teaches employees the benefits of DfA products especially the improvement of the commercial possibilities for such products or services. May such an approach also promote flexibility to meet not only the demands of DfA but also the diversity of devices, ubiquitous computing etc.?
   - 1.10. Concepts and standards are important for grounding the design of industrial education programs. Here is a partial list of terms, are there others that are key to the process; are there multiple definitions of them that need to be clarified?
     - Design for All
     - Inclusive Design,
     - Universal Design
     - How do you define the relationship between accessibility (for elderly and persons with disabilities) and usability?
     - Accessibility is an aspect or even a precondition for usability

- Usability is an aspect of accessibility
- User centered design

1.11. The following are a set of concepts and approaches that are considered to be important in DfA. How to best do this? Which ones are missing?
- Methods, tools and techniques to capture user requirements and evaluate designs with users.
- Interpersonal Skills for Teamwork, experience in communicating the Design for All concept with other members of a team
- Accessible content: knowledge on making content of documents, multimedia and Web sites accessible to all users, e.g. by making alternative forms of media available.
- Accessible interaction: knowledge about assistive and adaptive devices that enable alternative input and output, e.g. speech synthesizers, screen reader software, alternative keyboards, etc.
- Application domains and research where Design for All issues are being investigated, e.g., public access to information, health monitoring, technology enhanced learning, etc.

2. How /Where to teach

2.1. Employees should learn about recommendations and standards for DfA, how to do this?
2.2. In training employees, how to setup training courses that encourage their active participation not just as consumers; More courses needed for professionals where they could try out DfA products to learn about special needs and how the products worked. How to do this?
2.3. In training, the concept of DfA should be defined more precisely - there should be more case studies of good practice. How to capture these?
2.4. We need to create inter-disciplinary discussion groups in education, employees should learn interdisciplinary skills rather than only for one profession. How can training support this?
2.5. Do we need to emphasize the benefits of DfA products especially the improvement of the commercial possibilities for such products or services, and promote flexibility to meet not only the demands of DfA but also the diversity of devices, ubiquitous computing etc? If so how best to do this?
2.6. How can the needs of industry and the needs of the professions be made to converge?
2.7. Need to create inter-disciplinary discussion groups in industry – is this solely an intra-company issue, an inter-company issue?
2.8. How to implement specific and formal involvement with end-users and advocates.

3. Who to teach

3.1. Do we need to educate not only technicians and engineers but also other departments/professions like marketing and strategic planners etc.? How to identify which ones and how to justify the expense?
3.2. How to support managers at companies gaining an understanding of DfA.
3.3. Are there personal skills such as social awareness that should be taught?
3.4. How to involve multiple disciplines and how they related as well as marketing? How crucial to a company in supporting successful DfA?
3.5. The ability to prototype and storyboard with disabled users was useful, how to integrate this into the corporate structure
3.6. Closing the loop on DfA is the evaluation of courses and training. Professionals need the ability to evaluate accessibility. There need to be greater visibility for trained expert professionals. How to bring this into process. What are the details of evaluation that are important?
3.7. Human resource people might not know whom to hire, nor how to support/track the acquisition of DfA skills. How to support them?

4. When (sequence) to teach

4.1. Alternating between technical / theoretical classes may be a good approach. How to structure this?
4.2. Teaching DfA might start with immersion in the domain. Are multimedia presentations enough? How to structure direct interactions with end-users and associated professionals (i.e. special ed. Assistive technologists) directly?
4.3. How much training is enough? Would a good approach to be to schedule trainings over a long period of time (so that there is an alternation of training and work on products) or is it better to have the training in one concentrated set of sessions?

Annex B – The workshop participants

Participant	Association	Country
Prof Christian Bühler	Forschungsinstitut Technologie und Behinderung (FTB)	Germany
Laura Burzagli	The Centre for the Study of Microwave Physics (CNR)	Italy
Stefan Carmien	Fraunhofer Institute for Applied Information Technology (FIT)	Germany
Va'clav Chudacek	Czech Technical University in Prague (CTU)	Czech Republic
Dr Gerald Craddock	Centre for Excellence in Universal Design, Ireland	Ireland
Loris Di Pietrantonio	EU Commission	
Pier Luigi Emiliani	Institute of Applied Physics "Nello Carrara" (IFAC)	Italy
Alena Galajdova	Technical University of Kosice	Slovakia
Dewi Gani	SAP	
Fraser Hamilton	Designed for All Ltd	UK
Susan Hewer	The Royal Society for the encouragement of Arts, Manufactures & Commerce (RSA), facilitator break group 2, day 1	UK
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