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Enable Network of ICT Supported Learning for Disabled People

Deliverable 3.2

Methodologies for the Categorisation and Evaluation of ICT-Based Lifelong Learning for Disabled People

Workpackage 3: Data Analysis and Evaluation: Principles for the Use of ICT to Support Lifelong Learning by Disabled People and the Future Research Agenda

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Methodologies for the Categorisation and Evaluation of ICT-Based Lifelong Learning for Disabled People

Summary

This deliverable presents the first systematic approach to the classification and evaluation of inclusive ICT-based learning technologies and ICT-based learning technologies for disabled people. Classification is about putting learning technologies into categories so that different types of learning technologies can be distinguished from each other and their main features are clear. Evaluation of a learning technology is about making value judgements abut it, either in general or about particular features.

The deliverable will consider classification from the perspective of five aims (see Section 4 for details) which can be summarised as follows:

1. Providing a framework based on a technology description in order to determine and evaluate what is available, how this changes over time and identify gaps in provision, develop new technologies and modify existing technologies to improve accessibility.
2. Supporting learners, teachers and tutors in choosing appropriate technologies for themselves or a particular student or group of students in a given context.

A number of evaluation aims are presented in section 5.2. Their main features can be summarised as follows:

1. Evaluating the impact of technology use on user outcomes, including barriers to learning, self-confidence, motivation, increasing participation in learning activities and achievement of desired learning outcomes.
2. Evaluating various features of the technology, including accessibility, functionality, reliability and costs from the perspective of disabled learners and other stakeholders.
3. Facilitating the comparison of different technologies which fulfil similar functions.
4. Identifying gaps in technology provision and the need for modification and improvement of existing technologies.

These aims are related to summative evaluation which is aimed at helping users decide what technologies to use and for what applications and formative evaluation which is used to improve tool design during development (Davidson and Goldfinch, 1998).

The classification framework comprises three methodologies: a detailed methodology, a simple methodology, and a methodology for classifying the personal and contextual features which affect the use of learning technologies. The evaluation framework includes evaluation principles, divided into principles that affect all learning technologies and principles for evaluating learning outcomes; evaluation aims; and three evaluation methodologies. The evaluation methodologies include two simple and one detailed methodologies. One of the simple methodologies is mainly qualitative and largely intended for use by end-users. The other is both quantitative and qualitative and can be used by end-users or expert evaluators. Two versions are provided: (i) a list of evaluation topics plus instructions; (ii) sample questions to be used by end-users. The detailed evaluation methodology can be evaluated both quantitatively and qualitatively. Due to the extent of detail it is largely intended for evaluation by expert evaluators. However, questions could be developed for use by end users. The quantitative and qualitative simple and detailed evaluation methodologies are based on appropriate modifications of the simple and detailed evaluation methodologies respectively. The simple version additionally has a section for comments, suggestions for modifying the technology and overall evaluation. The detailed version additionally has a section for evaluating the impact of technology use on attitudes and ease of learning.

Development of the classification and evaluation methodologies involved a multi-stage process. This included synthesis of models obtained by the Network partners from a worksheet to produce a draft version and cycles of discussion, comment and validation using diverse ICT based learning technologies used in different partner countries.

The resulting methodologies have a number of important applications, including establishing for the first time a clear framework which can be used to discuss and evaluate existing ICT-based learning technologies for disabled people, identify gaps in provision or the need for modifications of existing technologies and support the design and development process for new technologies. The methodologies will also be valuable in identifying technologies suitable for particular learners and in supporting the determination of good practice and have an important role in informing policy and determining the future research agenda.

Keywords: classification, evaluation, methodologies, principles, aims, disabled learners.

1. Introduction

This deliverable presents the first systematic approach to the classification and evaluation of inclusive ICT-based learning technologies and ICT-based learning technologies for disabled people. Classification is about putting learning technologies into categories so that different types of learning technologies can be distinguished from each other and their main features are clear. Evaluation of a learning technology is about making value judgements about it, either in general or about particular features.

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Developments in ICT have led to a number of exciting possibilities for the use of ICT in education, including mobile learning e.g. (Kukulska-Hulme and Traxler, 2008; Motiwalla, 2007), microlearning (Hug, 2007) and games based learning e.g. (Hersh and Leporini, 2012). The use of ICT has a number of potential advantages for disabled learners, but there are also issues of the accessibility and usability of these technologies (Hersh and Leporini,

2012) and their match to the particular needs and learning styles of specific groups of disabled people. Thus some (groups of) disabled people may require existing learning technologies to be modified in order to use them either at all or to best effect. Others may require the use of one or more assistive technologies in order to access learning technologies, which may raise issues of the compatibility of learning and assistive technologies. The importance of assistive technologies in removing the barriers that disabled learners would otherwise experience to engaging in learning tasks and completing (post-secondary) education has been recognised (Day and Edwards, 1996; Edyburn, 2006).

This then raises the issue of what exactly is an ICT-based learning technology for disabled people, the original or modified learning technology, the assistive technology, the combination of learning and assistive technologies or all of these. Several European projects have developed educational ICT but lack of knowledge and classification of the available technologies are preventing best use being made of them.

Frameworks for classification and evaluation of ICT-based learning technologies for disabled people are required in order to determine and evaluate existing technologies and develop new ones. This could include identification of areas where new technologies or modifications of existing technologies are required; the prerequisites for accessibility and usability and compatibility with assistive access technologies and the characteristics of the disabled learners particular technologies are suitable for.

2. Overview of the state of the art

2.1 Classification

There does not seem to be any literature which deals specifically with the classification of ICT-based learning technologies for disabled people. However, there are two related areas of research literature. The first is the classification of assistive technology, a summary of which is given in (Hersh and Johnson, 2008a) and the second is the classification of related learning domains.

2.1.1 Assistive Technology Classification Approaches

The assistive technology classification approaches can be categorised as follows, though the distinctions are not totally clear cut: (i) domain categorisation; (ii) assistive technology systems modelling; and (iii) assistive technology outcomes modelling. The main domain categorisation approaches are the World Health Organisation International Classification of Functioning, Disability and Health (ICF) (WHO, 2001), and the International Standards Organisation standard ISO 9999: 2011 Technical Aids for Persons with Disabilities, Classification and Terminology. The ICF is an international classification developed by the World Health Organisation and has been accepted as a United Nations social classification. It is a hierarchical scheme based on a two part taxonomic structure: (i) functioning and disability and (ii) contextual factors. The classification is hierarchical with each part having two components and each component having further classifications. ISO 9999: 2011 is product and application orientated. However, it is purely a structured list of assistive technologies. The Assistive Technology Device Classification (ATDC) (Bauer and Elsaesser, 2012) is derived from the ICF. It has the five categories: type, user, health state qualifier, activities and participation domains and physical environments. The options under

the other categories are related to the type options of medical, assistive and universally designed.

Assistive technology systems modelling approaches include the hierarchical four component Comprehensive Assistive Technology (CAT) (Hersh and Johnson, 2008ab), Human Activities Assistive Technology (HAAT) (Cook and Hussey, 2002; Cook and Miller Polgar, 2007) and Student, Environment, Tasks and Tools (SETT) models (Zabala, 2005).

The CAT and HAAT model are both based on the addition of an assistive technology component to the human performance framework comprising the three components of human, activity and context (Bailey, 1989). The HAAT model has the following four components: (i) context or the social and physical environment in which the assistive technology is used; (ii) human person at the centre of the model; (iii) activity that the person would like to carry out; (iv) assistive technology used to overcome external barriers or obstacles. Further levels of description are provided for each of these components. For instance, the human person has the attributes of sensory inputs, central processing and effectors (motor outputs). The CAT model (Hersh and Johnson, 2008ab) has a hierarchical structure with the following four top-level components: (i) context, in which the assistive technology will be used; (ii) person i.e. the user, who should be at the centre of assistive technology design; (iii) activities, for which the assistive technology will be used; and (iv) assistive technology. Each of the four top level components has two further levels of classification which describe it in more detail. In principle, if required, additional levels could be added.

The SETT model (Zabala, 2005) aims to provide a framework for gathering and organising information to support assistive technology decision making in a school context in order to reduce device abandonment and underuse. Suggested questions are provided in each of the four domains: student, environment, tasks and tools. Student questions include what are the student's current activities and special needs and what does the student need to accomplish tasks which are difficult or impossible to carry out independently. It is suggested that the questions about the environment need to be very detailed. Tasks relate to detailed activities, such as reading a particular book. This then gives rise to the tools question of 'What needs to be included when developing a system of assistive technology for a student with these needs and abilities doing these tasks in these environments?' (Zabala, 2005). The SETT website (http://www.joyzabala.com/Documents.html) provides forms called 'scaffolds' to support the process. They cover the areas of consideration of AT needs, data collection, tool selection, and implementation and evaluation planning, with the latter involving a 12-step process. They can be modified (if credit is given), but unfortunately are based on the medical model of disability.

Many of the assistive technology outcomes modelling frameworks are related to quality of life approaches, an overview of which is given in Hersh and Johnson (2008a). The Matching Persons and Technology (MPT) Model (Fuhrer, 2000; Fuhrer et al., 2003; Scherer and Craddock, 2002; Scherer and Glueckauf, 2005) and the related framework for modelling the selection of assistive technology devices (Scherer et al., 2007) will be discussed briefly in the next section on evaluation. The Siva Cost Analysis Instrument (SCAI) is intended to assist assistive technology professionals and end-users in estimating the costs of a particular assistive technology system and comparing the costs of different options (Andrich, 2002). The USERfit model aims to provide a structured framework for a user centred approach to assistive technology design (Poulson and Richardson, 1998). It consists of the three main components: problem definition, functional specification and build and test. Education Tech Points is an educational outcomes model based on the six 'Tech Points' of referral, evaluation, extended assessment, plan development, implementation and periodic review (Reed and Bowser, 1998).

There are also a number of searchable databases of assistive technology products, devices, and services for which classification is also relevant, including the Disabled Living Foundation (http://www.dlf-data.org.uk/), ABLEDATA (www.abledata.com) and European Thematic Network on Assistive Technologies (http://www.etna-project.eu/) and European Assistive Technology Information Network (http://www.eastin.eu/en-GB/searches/products/index) databases,

2.1.2 Classification of Learning Outcomes and Other Aspects of Learning

While there are no classifications specifically of ICT based learning technologies, there are a number of related classifications, including of learning objects. The term has been variously defined, but is based on the idea of a reconceptualisation of learning into smallish self-contained re-usable units of learning and the combination of content, practice and assessment items which may be digital or non-digital and used in education, learning or training (Beck, 2010; IEEE, 2002). There is therefore a potential overlap with ICT learning technologies, depending on the definition used. However, the formalism and the fact that the categories used are not intuitively comprehensible makes it difficult to apply the taxonomies more widely. Many of the taxonomies are tabular with lists of types of objects and characteristics labelling the rows and columns and each square representing the combination of an object with a characteristic. Examples of objects include (Churchill, 2007; Convertini et al, 2005; Redeker, 2003: Wiley, 2000) (generative-)presentation, practice, simulation, conceptual models, information, contextual representations, generative-instructional (i.e. an interface which teaches how to do something), fundamental (single) and combined open or closed (learning object with additional components). Characteristics include (Convertini et al, 2005; Redeker, 2003: Wiley, 2000) the number of single elements e.g. video clips, images combined in the learning object; the main function; the types of objects included; the type of logic in the algorithms and processes; the potential for reusing the learning object in the same area; and whether other learning objects can access and reuse the components.

A related area is courseware, with models including the following relationship of three different types of learning to three different types of courseware (Mayes and Fowler, 1999) as follows: (i) Primary courseware presents subject matter and most current courseware is primary. It is related to the conceptualisation stage of learning or the initial contact between learners and concepts. (ii) Secondary courseware is the environment and set of tools learners use to carry out learning tasks and the task materials themselves. It is related to the construction stage in which concepts are combined through carrying out meaningful tasks. (iii) Tertiary courseware involves the reuse of the learning experiences of other learners, for instance a database of answers to frequently asked questions collected from real learning experiences. It is related to learning dialogues, particularly those at a distance.

A de facto rather than explicit model of systems for supporting collaborative learning is presented by Jermann et al. (2001). It has the following three components: (i) systems that reflect or make learners and teachers aware of participants' actions; (ii) systems that monitor the state of interaction, further divided into those that that do and do not reveal the information to users; and (iii) systems that offer advice.

There are a number of different classification schemes for learning environments, many of which are based on the three components of learning goals; teacher and learner roles; and learner roles in relation to each other. One example (de Kock et al., 2004) includes the following components: (i) learning goals: knowledge of learning content and process; attitudes to learning content and process; cognitive, affective and social learning skills; and

transfer skills; (ii) teacher and learner roles: behavioural, developmental and apprenticeship models; and (iii) learner relations to each other: competitive, individual, cooperative.

2.2 Evaluation

Evaluation involves value judgements, for instance how good a learning technology is, how much you like it, how accessible it is or how useful it is in helping you learn. Even when these judgements are based on measurable variables, there is still a subjective element, as the measurable values need to be assigned to assigned to a valuation scale and there are different ways of doing this. In addition to the importance of values, the social and political nature of evaluation has been noted (Oliver and Harvey, 2002). Two types of literature are relevant in considering the evaluation of inclusive learning technologies or learning technologies for disabled people: the literature on the evaluation of learning technologies (for non-disabled people) and the literatures on assistive technology outcomes. Both will be reviewed briefly.

2.2.1 General Principles and Frameworks

There is a body of literature on the evaluation of learning technologies, but little attention has been paid specifically to the evaluation of inclusive learning technologies or learning technologies for disabled people. There are a number of different approaches, but not a generally accepted methodology or even a set of generally accepted principles. Ongoing debates (Oliver, 2000) include the relative merits of quantitative and qualitative approaches, the move from expert to practitioner based evaluation and the provision of tools for practitioners, the role of checklists, the influence of the quality agenda and the definition and measurement of costs. The evaluation of learning (and assistive) technologies is context dependent, making it important that the evaluation takes place in the context the technology will be used in (Jackson, 1998). It has also been suggested that evaluation should aim to identify the factors contributing to its success if successful in addition to whether or not a resource works (Tolmie et al, 1998).

Four main types of evaluation with different aims have been identified (Davidson and Goldfinch, 1998):

- Formative evaluation to improve tool design during development.
- Summative evaluation to help users make decisions on what technologies to use and for what applications.
- Illuminative evaluation, which is an open ended method aimed at revealing unexpected important issues in a particular situation.
- Integrative evaluation aimed at helping users make the best use of a particular tool. It can be considered a type of formative evaluation of the whole learning and teaching situation rather than of a particular tool.

Three main approaches to deciding the types of factors evaluated have been identified (Tolmie et al., 1998): (i) the ICT approach focusing on the effects of the technology or system; (ii) the individual differences approach focusing on the effects of individuals' attitudes, experiences and abilities; and (iii) the relational approach focusing on relationships between users. The problems in measuring the impacts of the use of learning technologies (and other approaches) on learning with regards to both skills and understanding have been noted. In particular, the introduction of technology may fundamentally change what is learnt, giving rise to the need for a different type of assessment of learning. In addition, the fact of being studied may lead to changes in behaviour. Potential solutions involve using process oriented assessment and direct observation (Oliver and Harvey, 2002).

There are a number of different sets of pedagogical principles, learning models and other theoretical frameworks, which could form the basis of quantitative and/or qualitative evaluation. The seven principles of good practice in undergraduate education were first published in 1987. They are probably relevant to other types of education and can be summarised as follows (Chickering and Ehrman, 1996). Good practice: (i) encourages contacts between students and teachers; (ii) develops reciprocity and cooperation among students; (iii) uses active learning techniques; (iv) gives prompt feedback; (v) emphasises time on task; (vi) communicates high expectations of students' ability to learn; (vii) respects diverse talents and ways of learning. However, though these principles include different talents and approaches to learning, they do not consider accessibility issues.

The CRESST model of learning (Baker and Mayer, 1999) is based on five types of cognitive demands: (i) understanding content, (ii) collaboration or teamwork, (iii) problem solving, (iv) communication and (v) self-regulation. The structure of observed learning outcome (SOLO) taxonomy provides a hierarchy of five levels of learning, with levels 4 and 5 qualitatively different from the earlier levels (Jackson, 1998). However, it is not necessarily easy to identify the different learning levels. Suggestions include analysis of written work or reflective verbal or written reports on learning activities. The levels are as follows:

1. Prestructural: the student misses the point and does not attempt the task appropriately.
2. Unstructural: one or a few aspects of the task are understood and used.
3. Multi-structural: learning of several aspects of the task, but no integrated understanding of the whole .
4. Relational: understanding of relationships as well as components.
5. Integrated abstract: the understanding of relationships and the whole can be generalised to other areas or are related reflexively to the learner.

Kirkpatrick's (1994) four levels for evaluating training are: (i) reaction or learning satisfaction and reaction to the program; (ii) learning or changing attitudes, improving knowledge and/or increasing skills; (iii) behaviour or the ability to apply knowledge to new situations; and (iv) results or overall benefits (to the organisation). However, the underlying philosophy seems to be based on the benefits and costs to the organisation rather than the learner.

Existing (practical) evaluation frameworks have been divided into the following four categories (Oliver et al, 2001), though not all frameworks fit into these categories: (i) evaluation of educational innovation projects over the whole lifecycle from origin to outcomes; (ii) evaluation of websites (checklists); (iii) the effectiveness and outcomes of learning frameworks, including higher order thinking, collaboration, reflection, motivation and creativity; and (iv) evaluation toolkits and handbooks for practitioners.

Various approaches have been suggested for improving the validity of software evaluation criteria. They include involving experts with different types of expertise in their development (Bangert-Drowns and Kozma, 1989) and basing decisions on an empirically tested model for instructional design (Ellis et al., 1993). Formal methodologies for involving different experts include collaborative evaluation with convergent participation. It has two stages: (i) asynchronous evaluation by evaluators with diverse and complementary expertise; followed by (ii) moderated discussion of the evaluation using a synchronous conferencing system (Vargo et al, 2003). Other approaches are based on the four main components of: subject matter content; learners; instructional methods; and technology (Bangert-Drowns and Kozma, 1989; Tengen, 1992).

2.2.2 Checklists, Handbooks and Toolkits

Checklists (Oliver, 2000) comprise lists of factors or criteria which are used to review resources against and provide a structured approach to evaluation. Their use is not restricted to websites. They are relatively easy to use and can provide a comprehensive approach, though the level of detail and number of questions vary considerably and there are different types of formats for qualitative and quantitative information (Tergan, 1998). However, they have also been extensively criticised. Potential disadvantages include the focus on technical rather than educational issues (OTA, 1988), and on similarities rather than differences when the same types of technologies are evaluated (Squires and McDougall, 1994), the lack of consistency between different raters and the lack of criteria tailored to specific applications (Tergan, 1998). Frequently scores are aggregated, generally without weighting (Oliver et al., 2001), preventing consideration of the performance on different factors.

A number of different checklists have been developed. Blease (1988) categorised learning software into drill and practice, arcade, simulation game, lab simulation, and content-free tools, with each category having a long list of questions grouped into headings such as the achievement of stated aims, documentation, presentations and layout, and friendliness and flexibility. However, recent technological developments are not covered. The Evaluation and Development Review Unity (EDRU, 1992, Sommerlad, 1992) comprises a booklet overviewing various aspects of evaluation, including curriculum and staff development and implementing evaluation strategies, and a guide to carrying them out, which aims to encourage reflection rather than provide detailed recipes. An approach originally suggested for the learning object review instrument, but with wider applications, rates ten qualities on a five point scale from absent to perfect. The qualities include presentation: aesthetics, and design for learning; motivation; interaction usability, and feedback and adaptation, and accessibility (Vargo et al., 2003).

The Evaluation Cookbook (Harvey, 1998) summarises a number of methodologies in a simple form with hints and tips. The ELT toolkit (Oliver et al., 1998) presents a six-stage process for the design of evaluation comprising (i) stakeholder identification; (ii) selecting and refining evaluation questions taking into account stakeholders, (iii-v) selecting an evaluation methodology and data capture and data analysis techniques; and (vi) presentation format. At each step users complete activities supporting the use of a structured knowledge base to help informed decision making that would otherwise be beyond their level of expertise. The first two and last stage relate to the context and the middle three stages to the study details. A version of this toolkit (Conole et al, 2001) has three components: the evaluation planner, adviser and presenter, and a modular structure. The planner helps define the scope and audience of the evaluation, has seven main stages and is linked to questions, guidelines and exercises. The adviser uses the output from the planner as a starting point for planning the evaluation implementation and guides the user through data collection and evaluation choices. The presenter supports dissemination of the evaluation findings to the stakeholders identified in the planner and encourages reflection on result validity.

The Flashlight approach (Ehrmann, 1997, 1998, 1999) is based on the following premises:

- The choices learners and teachers make about the organisation of learning and teaching rather than technology influence learning outcomes and it is the role of modern technology to increase the available options.
- Where it is difficult to evaluate learning outcomes, evaluation of the extent of implementation of the seven principles of good practice (Chickering and Ehrmann, 1996) can be used as a substitute.

The Flashlight Project has produced the Current Student Inventory. It is a toolkit of nearly 500 indexed questions which can be used to produce surveys, questionnaires and focus group and interview protocols. It can be used to obtain information and opinions from learners about technology use and its impact on learning, access to education, teacher-learner and learner-learner interactions, amongst other applications.

The CUTSD Project (Phillips et al., 2000) has developed a handbook of design and implementation guidelines for whole project evaluation. Unusually it includes the analysis and design stage with a focus on curriculum analysis, teaching for learning analysis and specification of innovation. The other three stages are development (formative monitoring of learning environment and process); implementation (summative evaluation of the learning process, learning outcome, and innovation appropriateness); and institutionalisation (impact and maintenance evaluation). The handbook suggest methods suitable for obtaining evidence to support formative or summative evaluation at the different stages.

2.2.3 Assistive Technology Outcomes

Assistive technology evaluation has generally focused on the resulting outcomes rather than the design and features of the technology. Many of the approaches have been influenced (Hersh and Johnson, 2008a) by quality of life approaches. There is still considerable disagreement about the definition and measurement of quality of life (Beckie and Hayduk, 1997). However, this has generally been based on traditional health-status measures, under the assumption that they are equivalent to quality of life, and a functional perspective in relation to the ability to perform daily living activities, with disability both considered and measured as something negative (Bowling and Windsor, 1999). However, there is evidence of a lack of agreement between individuals' ratings of their own health-related quality of life and those of health care providers or relatives (Slevin et al., 1988; Spangers and Aaronson, 1992). Studies also indicate little correlation between individuals' 'subjective' judgements of well-being and 'objective' measures of income, educational attainment and health status (Diener, 1984; Eid and Diener, 2004). Health related quality of life measures have the further disadvantage of being formulated for 'patients', which inappropriately medicalises the experiences of disabled people.

An approach, which is more compatible with the social model of disability and empowering to disabled people would replace the idea of unaided functioning by consideration of independence and autonomy. Here independence is understood in the sense of 'control of their life and choosing how that life is led.....(and) the amount of control they have over their everyday routine' (Brisenden, 1986). Autonomy is defined as the ability to plan one's own life, to enter into relationships with others and together actively participate in the construction of society. These definitions are applicable to both disabled and non-disabled people. A number of assistive technology outcome measures which draw on quality of life approaches will be presented.

Matching Persons and Technology (MPT) comprises a six-step procedure for use in determining outcomes and the appropriate assistive technology for a particular person in a given environment (Fuhrer et al., 2003; Scherer and Craddock, 2002). The approach is based on the medical model of disability and aims to determine 'limitations' on functioning and identify goals and technologies that could be used to improve functioning, as well as personal characteristics, experiences and attitudes to technologies and degree of satisfaction with different aspects of life.

The Quebec user evaluation of satisfaction with assistive technology (QUEST 2.0) aims to evaluate satisfaction with a wide range of assistive technology (Demers et al., 2002ab),

using a linear general framework (Simon and Patrick, 1997). Satisfaction is defined as 'a person's critical evaluation of several aspects of a device' and may be influenced by expectations, perceptions, attitudes and personal values. The second version has 12 items rated on a 5-point satisfaction scale. The items are divided into the following two scales (Demers et al., 2002ab): (i) device scale, consisting of comfort, dimensions, simplicity of use, effectiveness, durability, adjustments, safety and weight; and (ii) services scale, comprising professional services, follow-up services, repairs/servicing and service delivery. The scores are averaged to give average scores for device satisfaction, satisfaction with the associated services and total satisfaction.

The psychosocial impacts of assistive devices scale (PIADS) (Day and Jutai, 1996; Day et al., 2002; Jutai and Day, 2002) is a 26-item self-report questionnaire that aims to assess the effects of assistive device use on functional independence, well-being and quality of life. It is divided into three sub-scales: competence, adaptability and self-esteem. Individually prioritised problem assessment (IPPA) (Wessels et al., 2002) is intended to assess the effectiveness of assistive technology provision by determining the extent to which problems and barriers encountered by the user in daily activities have been reduced. The respondent is asked to identify up to seven barriers in carrying out everyday activities that could possibly be countered through the use of assistive technology. For each issue an IPPA form is completed and the respondent identifies the importance of the activity and the level of difficulty in carrying it out using a multiple choice score. Life-H aims to measure the quality of social participation in terms of the manner in which daily activities and social roles, called life habits, are carried out and any disruption of these life habits (Noreau et al., 2002). It includes a range of different activities divided into twelve categories (Fouygerollas et al., 1998).

The LIFE-H assessment consists of two different questionnaires, a short version for general screening and a longer version for the more detailed assessment of specific areas of social participation. The level of difficulty in performing activities and the type of assistance required are measured on a 10 point scale and levels of satisfaction with the accomplishment of each activity are measured on a five-point scale. It could be used to investigate the impact of assistive technology by comparison of assessments with and without the technology, but its use as an outcome measure has been relatively limited (Fouygerollas et al., 1998). OT (occupational therapy) FACT (Smith, 2002) is a software based assessment approach to measuring 'function' rather than quality of life. However, both the software and the inherent philosophy based on 'deficits' are becoming dated.

The Consortium for Assistive Technology Outcomes Research (CATOR) (Jutai et al., 2005) is developing a taxonomy of assistive technology outcomes to support the classification of outcomes from the use of any assistive device. The approach is based on three sets of descriptors: effectiveness or the impact on the ability to function, social significance or the impact on society and other people, and subjective well being or the impact on users' lives and their feelings about them. The CATOR taxonomy aims to provide a single hierarchical classification based on this framework and the components of the medical model International Classification of Functioning, Disability and Health (WHO, 2001). The framework is illustrative rather than all-inclusive.

The Assistive Technology Outcomes Measurement System (ATOMS) project (Edyburn and Smith, 2004) is developing a prototype of a large scale assistive technology outcome measurement system. It uses dynamic norming to overcome the problems resulting from the fact that there are only small numbers of disabled people with impairments with similar impacts and who use the same assistive technology. This involves extracting data from a real-time database to produce comparative norm groups which can be used for comparisons. The proposed system has seven components, including the theoretical

framework; expertise, training, and assessment instruments; data collection, assimilation, reduction and visualisation, and data-based decision-making.

There has also been some specific attention to outcomes measurement of assistive technology used in education. For instance there is an educational technology version of matching person with technology which considers attitudes, preferences and approaches to learning and technology. The School Function Assessment (Coster et al., 1999) uses judgement based criterion referenced assessment to provide a detailed picture of the extent to which students with different impairments are carrying out school activities, including moving around the school, using classroom materials, interacting with peers and personal care.

Education outcome domains for disabled students are considered to relate to their performance or participation in educational activities (Smith, 2000). They include performance in academic subjects; manipulation of educational equipment such as test tubes and keyboards; managing educational materials, such as organising files of data; and mastering study skills, such as home work and participating in group discussions. Technology use is also affected by factors such as battery duration, reliability and the availability of appropriate support. There has been some discussion of the relative merits of the use of subjective data based on, for instance, student (and family) perceptions of the device and satisfaction with it and objective data, such as performance on academic tests, levels of independence and successful integration into class activities (Smith, 2000). However, the difference between objective and subjective measures is not clearly defined. Outcome measurement is further complicated by the fact that assistive technology is general used in combination with other services, such as general education, a personal support tutor or assistant, and various therapies, making it difficult to determine the impact due to the assistive technology and that due to other factors (Smith, 2000).

3. Methodological Approach to Obtaining the Classification and Evaluation Frameworks

3.1 Classification

The classification methodology presented in this deliverable draws on the data collection in Workpackage 2 on the current state of the art with regards to ICT-based tools and technologies for disabled learners and the factors that affect their use in the 16 partner countries. Eight cycles of model development, validation, commentary and modification were carried out to obtain the final version presented here.

The first stage in the process of obtaining classification methodology was based on a worksheet completed by the partners (see Appendix 1). The worksheet involved the partners evaluating the four factors of the disabled person, the context, the learning technology and the learning activity derived from the CAT, HAAT and SETT models presented in section 3.1 and then being led through a process of developing additional factors and formulating a structure for them. In order to do this the partners drew on the knowledge of ICT learning technologies obtained as a result of collecting tools and technologies in Workpackage 2. Each partner then validated their classification approach by applying it to some of the technologies they had identified in Workpackage 2. This validation process was also used to identify any necessary modifications to the classification to give a better fit or description of these technologies. The Workpackage leader, who developed the worksheet, very deliberately avoided giving the partners any information about the classification of ICT learning technologies other than the top level four component

structure (disabled learner, learning technology, context, learning activity/ies) in order to avoid biasing the outcomes and thereby not obtaining the best possible results.

The second stage involved the workpackage leader producing a first draft of the final methodology through a process of synthesis and validation of the methodologies produced by the different partners. She then compared the model to the second and third levels of the CAT model (Hersh and Johnson, 2008ab) and used this comparison to add a number of additional components, based on modified versions of elements in the CAT model. The second and third level components of the person, context and assistive technology elements of the CAT model are stated below:

Person:
- Characteristics: personal information, impairments, skills, preferences.
- Social aspects: community support, education and employment
- Attitudes: attitudes to assistive technology, general attitudes

Context:
- Cultural and social context: wider social and cultural issues, user's social and cultural context
- National context: infrastructure, legislation, assistive technology context
- Local settings: location and environment, physical variables

Assistive technology
- Activity specification, task specification, user requirements
- Design issues: design approach, technology selection
- System technology issues: system interface, technical performance
- End-user issues: ease and attractiveness of use, mode of use, training requirements, documentation

The activities component in the CAT model covers a wide range of activities, whereas only learning activities are of interest here. The CAT rather than HAAT or SETT models was chosen, as it is based on the social model of disability and is more flexible and less restrictive than the HAAT model and the components are stated explicitly which is not the case of the SETT model.

The resulting methodology was fairly long and detailed. There are a number of applications that require this type of detailed approach. However, many users are likely to find it too complicated and time consuming, giving rise to a need for a simpler approach based on a small number of criteria which summarises the model. A list of six classification criteria was therefore developed.

The third stage involved the workpackage leader validating the methodology by applying it to a number of learning technologies she was familiar with. This resulted in a number of small changes. The fourth stage involved validation by some of the partners applying the methodology to one learning technology used in their countries.

The fifth stage involved discussion by the Enable Network partners in small groups at a project meeting in Glasgow. This resulted in a number of comments and suggestions. A number of modifications were made to the methodologies in response to these suggestions, including adding three additional criteria to the simple methodology.

The sixth stage involved circulation of the updated methodologies to the partners and further modifications to take into account their comments. The seventh stage involved a final validation through application to nine different technologies in use in the partner countries.

These technologies were chosen to cover a number of different values on important variables, such as the intended user groups and the type of technology. The partners were invited to make comments and suggest further changes. However, the only comments received were that the methodology worked very well and was easy to fit to the technology; and that the accessibility component on the methodology should be related to the World Wide Web Consortium (W3C) Web Content Accessibility Guidelines (WCAG) version two (WCAG 2) (http://www.w3.org/TR/WCAG20/). In response to the second comment, small changes were made to the accessibility section of the methodology.

At this stage it was also decided by the workpackage leader in consultation with the partners to change the name of the first top level category from 'disabled learner' to 'disabled learner or end-user'. While the methodologies focus on classification and evaluation of learning technologies for disabled learners, the classification and evaluation are also relevant to other users who may not be either learners or disabled.

A later comment was received from one of the partners, suggesting that the additional personal and contextual factors in the classification methodology should be separated from both the classification and evaluation methodologies. The final stage was therefore the presentation of these factors as a separation classification of end-user and contextual factors that affect the use of learning technologies.

3.2 Evaluation

Work was initiated on the evaluation framework after completion of the second stage of the development of the classification framework. It was again carried out in a number of stages. The first stage was drawing up a simple evaluation methodology based on the six criteria of the simple classification methodology plus a further three criteria obtained from examination of the detailed classification methodology. The second stage involved validation of the methodology by application to a number of technologies in use in the partner countries.

The third stage involved small group discussions by Enable Network partners in small groups at a project meeting in Glasgow. However, most of the comments from this meeting were focussed on the classification rather than the evaluation framework.

Therefore to support further development of the framework the fourth stage a short questionnaire (see Appendix 2) asking about the aims of evaluation, who should carry out the evaluation and the process, was drawn up and distributed to partners, members of the End-User Advisory Committees and other contacts. At the same time an extensive literature survey was carried out. A synthesis of the information received from partners and other contacts, information from the literature and the workpackage leader's own knowledge and expertise was used to produce a list of principles and aims for evaluating inclusive ICT based learning technologies and ICT based learning technologies for disabled people. The principles and aims were then used to produce several different evaluation methodologies plus principles for evaluating learning outcomes.

The fifth stage involved the partners commenting on the evaluation methodologies, aims and principles and changes being made as a result of these comments. The sixth stage was validation of the evaluation methodologies by application to the same technologies with varied characteristics as had been used to validate the classification methodologies. The validation process showed the appropriateness of the methodologies, but that they could usefully be consolidated into three separate methodologies. The final stage involved consolidation of the various methodologies into three methodologies. This involved extending Section E of the detailed methodology on attitudes to attitudes and ease of learning and recognising that the methodologies evaluation of the impacts on motivation and

self-confidence, and ease of learning are detailed question expansions of this section. These questions have been edited and are now presented as Appendix 3.

4. Classification Framework

When producing a classification it is generally important to understand what aims it is intended to achieve in order to ensure that it can be used to achieve them without becoming so long and complicated as to be of little practical use. The following main aims will be considered:

1. Provision of a framework to facilitate determination of what technologies are available and how this changes over time, evaluation of these technologies and identification of gaps in provision.
2. Provision of a framework to support the development of new technologies to meet particular needs.
3. Supporting the modification of existing technologies by facilitating identification of the prerequisites for accessibility and usability and compatibility with assistive access technologies, as well as the characteristics of the disabled learners particular technologies are suitable for.
4. Supporting learners in choosing appropriate ICT learning technologies.
5. Supporting teachers, tutors and trainers in making choices of learning technologies to use with particular groups of students.

The five aims listed above can be synthesised and summarised in the following two aims:

1. Providing a framework based on a technology description in order to determine and evaluate what is available, how this changes over time and identify gaps in provision, develop new technologies and modify existing technologies to improve accessibility.
2. Supporting learners, teachers and tutors in choosing appropriate technologies for themselves or a particular student or group of students in a given context.

In addition to other considerations, as determined by the partner working groups, the classification should be sufficiently flexible to take account of future changes or developments in learning technologies. This probably requires the classification to be independent of existing technology paradigms. However, this is not easy, since thinking about (learning) technologies tends to be influenced by existing technology paradigms.

The classification framework comprises the aims listed above and three classification methodologies, which will be presented in the following three sub-sections. The first, presented in section 4.1, is the very detailed classification obtained by synthesising the partner inputs. This is based on the four factors of the disabled learner, the learner technology, the context and the learning activity.

The second simpler classification, presented in section 4.2, provides a summary of the main factors in the detailed classification and thus gives a good overview of the main features of a particular technology. It therefore enables basic comparisons of different technologies to be carried out and gives users an overview of whether a particular technology will meet their needs. The fact that it is does not provide the degree of detail of the detailed methodology has both advantages and disadvantages. In particular, the greater simplicity will make it easier and quicker to use. However, the trade-off for this is the reduced amount of detail.

The third methodology, presented in section 4.3, presents context and end-user dependent factors which can be used to give a descriptions of a particular end-user or group of end-users and their context. This will facilitate determining what types of end-user a particular technology is suitable for and supporting end-users in choosing appropriate technologies.

4.1 Detailed Classification Methodology

A Disabled learner or end-user

1. Accessibility features provided
   - 1.1 Compatibility and usability of all features with assistive technology eg. screen readers, keyboard with shortcuts, switch or other keyboard emulation and pointing device(s)
   - 1.2 Text representations of all visual and audio features, magnification and options to choose the colour of text and background
   - 1.3 Low cognitive and other demands and low memory requirements, including division into short tasks, use of clear, precise language, particularly for instructions and avoidance of time pressures
   - 1.4 The provision of sign language and communication support
   - 1.5 Customisation options, including the ability to turn features such as visual and sound effects, colour, scrolling text, animation on and off, with the non-stimulation option the default.
   - 1.6 Design for ease of navigation, including with screen readers.
   - 1.7 Accessibility of features for teachers and experts, including course creation, administration and editing.

2. Skills/education level/knowledge
   - 2.1 Literacy, numeracy and language skills
   - 2.2 Computer/IT skills
   - 2.3 Background/general knowledge or other skills
   - 2.4 Subject specific and which subjects
   - 2.5 Physical skills to use the tool or technology
   - 2.6 Learning level of subject/topic or independent of learning level

3. Personal characteristics
   - 3.1 Age independent or suitable for a particular age group or groups
   - 3.2 Gender independent or more suitable for men or women
   - 3.3 Whether the design takes into account cultural factors and, in particular, the culture of the main target end-users.
   - 3.4 Designed for users with particular interests and hobbies and these interests and hobbies
   - 3.5 Suitable for users with a particular learning style or approach or independent of learning style
   - 3.6 Suitable for users with a particular educational background and experience or independent of educational background and experience.

B Learning Technology

4. Type of technology
   - 4.1 Type of platform(s) – platform independent, suitability for stationary use only (e.g. PC), suitability for mobile use only (e.g. PDA, smart phone) or dedicated/stand alone device
   - 4.2 Single technology/tool or package of technologies/tools
   - 4.3 Learning technology; assistive technology; communication, collaboration and exploration technology; learning support technology; or multi-functional technology
   - 4.4 Facilities provided by the technology
   - 4.5 Underlying pedagogy, if relevant

5. Interface

5.1 Types of input and output e.g. mouse and keyboard, Braille keyboard (input); screen, Braille display, screenreader (output).
5.2 Amount of training required to use the interface
5.3 Intended for a particular user group or suitable for a range of different user groups (design for all)
5.4 Availability of customisation options
5.5 Languages supported

6. Use/availability factors
   6.1 Free/open source or commercial, free or charge (but not open source), other, costs and licence requirements
   6.2 Ease of availability

7. Technical factors
   7.1 Compatibility with and ability to import and export data from other software e.g. Microsoft Office or LibreOffice
   7.2 Compatibility with different operating systems or specific to a particular operating system
   7.3 Memory and other technical requirements
   7.4 Availability of accessible documentation such as user manuals, training, on-line help and helpline
   7.5 Maintenance/updating requirements and costs

C Context

8. Requirements
   8.1 Minimum time for effective use
   8.2 The need for a calm environment without noise or disturbances
   8.3 Compatibility with older versions of hardware and software or whether the most recent versions are required for (effective) functioning

9. Learning context
   9.1 Compatibility with synchronous learning, asynchronous learning or both
   9.2 Compatibility with online learning, offline learning or both
   9.3 Compatibility with individual learning, group learning, teacher supported learning and/or learning communities
   9.4 Independence of educational level or suitability for particular educational level(s) and, if so, which one(s)
   9.5 Suitability for use in vocational, re/training, rehabilitation, qualification-related education and/or informal learning

D Learning Activity/ies

10. Type of activity
    10.1 Subject specific and subject or non-subject specific
    10.2 Type of learning – skills, knowledge, understanding, attitudes and values
    10.3 Level of difficulty or complexity
    10.4 Learning, retraining, rehabilitation, revision or assessment,
    10.5 Nature of activity - exercises, tutorials, games, videos. quizzes etc
    10.6 Individual or group activity
    10.7 Student or teacher directed and centred

11. Other
    11.1 The extent of learner control of confidentiality

4.1.1 Relationship of the Classification Model to W3C WCAG 2 Guidelines

The classification items listed under accessibility have both similarities to and differences from those in the World Wide Web Consortium (W3C) Web Content Accessibility Guideline (WCAG 2) (http://www.w3.org/TR/WCAG20/). These guidelines are the best known, though by no means the only approach to accessibility. They are aimed at websites, rather than ICT based learning tools, though they do have wider applicability. They are also intended for web developers and authors, who can be assumed to have some degree of technical knowledge, whereas the classification in this deliverable has a much wider audience, including disabled learners, who may have little technical knowledge or knowledge of the associated terminology. Therefore, the terms used in the classification methodology need to be easily comprehensible by a wide audience. It should also be noted that WCAG 2 has four main principles, 12 guidelines and 64 criteria. The 12 guidelines clarify and explain the four criteria, the meaning of which might not otherwise be immediately obvious, whereas the elements in the classification methodology need to be immediately comprehensible. Since the classification methodology covers a wide range of other issues in addition to accessibility, it would not be feasible for it to have this number of accessibility criteria. In addition, some of what could be considered accessibility issues have been covered under other headings.

WCAG principle 1: Perceivable, with guidelines: 1.1 Text alternatives for non-text content; 1.2 Alternatives for time based media; 1.3 Content that can be presented in different ways without losing information; 1.4 Easier for users to see and hear content; is covered by Classification Methodology 1.2 Text representations of all video and audio features; 1.5 Customisation options; and 9.1. Compatibility with synchronous learning, asynchronous learning or both. However, some issues relating to presentation of content may be more relevant to the learning content used with the learning tool than the tool itself.

WCAG principle 2: Operable, with guidelines: 2.1 Make all functionality available from a keyboard; 2.2 Provide users enough time to read and use content; 2.3 Do not design content in a way that is known to cause seizures; 2.4 Provide ways to help users navigate is covered by Classification Methodology 1.1 Compatibility and usability of all features with assistive technology; 1.5 Customisation options, with the non-stimulation option the default; and 1.6 design for ease of navigation. 2.2 relates to the way content is used with the technology rather than the technology itself and is therefore not covered.

WCAG principle 3 Understandable, with guidelines: 3.1 Make text content readable and understandable; 3.2 Make web pages appear and operate in predictable ways is covered by Classification Methodology 1.3 Low cognitive and other demands and low memory requirements; and 1.4 The provision of sign language and communication support. Guideline 3.3 help users avoid and correct mistakes is not directly covered, as it is not always appropriate in a learning technology, since making and discovering mistakes is often part of how people learn. This relates to pedagogical principles which are most frequently determined by the learning context rather than the technology.

WCAG principle 4. Robust, with guideline: 4.1 Maximise compatibility with current and future user agents, including assistive technologies is covered by Classification Methodology 1.1 Compatibility with assistive technology; and 8.3 Compatibility with older versions of hardware and software.

It should be noted that Classification Methodology 1.4 The provision of sign language and communication support goes beyond the associated WCAG guideline on making text content readable and understandable. The classification methodology also has an additional accessibility feature: 1.7 Accessibility of features for teachers and experts, including course creation, administration and editing. This is particularly important in an educational context. It may also be relevant to disabled learners, where collaborative course development between teachers and learners is taking place. More advanced disabled learners may themselves be involved in editing or developing learning materials.

4.2 Simple Classification Methodology

Disabled learner or end-user

1. The accessibility features provided
2. Level of skills and knowledge required.
3. Range of user characteristics technology is designed for.

Learning technology

4. Learning technology; assistive technology; communication, collaboration and exploration technology; learning support technology; or multi-functional technology
5. Learning activities supported
6. General/skill based or subject specific

Availability and use factors

7. Open source or commercial, free of charge (but not open source), other
8. Ease and intuitiveness of use for disabled learners
9. Type of platform(s) – platform independent, suitability for stationary use only (e.g. PC), suitability for mobile use only (e.g. PDA, smart phone) or dedicated/stand alone device

4.3 Classification of Personal and Contextual Factors that Affect the Use of Learning Technologies

A Disabled learner or end-user

E1 Attitudinal and learning related factors

- E1.1 Degree of motivation, reason for learning and learning objectives
- E1.2 Self-perception as learner – achiever, underachiever, successful learner
- E1.3 Self perception and adaptation as a disabled person
- E1.4 Attitude to learning and other (new) technologies
- E1.5 Independence and openness to new approaches
- E1.6 Ease of learning
- E1.7 Conflicting demands on the learner and the extent to which they prioritise learning
- E1.8 Confidence in using ICT learning systems

C Context

E2. Local support mechanisms

- E2.1 Availability of assistance and support from family and friends
- E2.2 Availability of time for learning
- E2.3 Availability of suitable space and technologies at home for learning e.g. computer with internet connection
- E2.4 Availability of teaching and IT staff and their skills

E2.5 Availability of trouble shooting assistance

E3. Setting
- E3.1 Formal or informal learning and type of setting
- E3.2 Mainstream or specialised/segregated
- E3.3 Contextual learning framework and pedagogies
- E3.4 Alone or presence of teacher, family or friends
- E3.5 Policy on the use of mobile devices (formal settings)
- E3.6 Type of infrastructure available e.g. availability of computers and uninterrupted power supply.

E4. National support mechanisms
- E4.1 Availability of ICT
- E4.2 Availability of funding for learning technologies
- E4.3 Legislation on the right to access education

5. Evaluation Framework

There is a considerable body of relevant work on evaluation. However, existing approaches to evaluation generally either consider learning technologies for non-disabled students or assistive technology outcomes. SETT (Zabala, 2005) includes an evaluation component for assistive technologies used in education, but has a medical model focus and is largely aimed at assistive technology rather than educational technologies in the widest sense.

The evaluation framework presented here is aimed specifically at learning technologies for disabled students and inclusive learning technologies. It comprises sets of principles and aims and three evaluation methodologies. The majority of the principles are relevant to all types evaluation and are presented in section 5.1. Additional principles, which are specific to the evaluation of learning technologies, are presented in section 5.2. The aims are presented in section 5.3. The principles and aims were obtained from the an analysis and synthesis of responses to the short evaluation questionnaires (see appendix 2), an overview of the literature referenced in section 3.2 and the workpackage leader's experience and expertise. The evaluation questionnaires were completed by three partners and 13 people from outside the consortium, including members of the End User Advisory Committees.

The evaluation methodologies are presented in sections 5.5, 5.6 and 5.7. The first methodology (section 5.5) is a simple and quick methodology, aimed largely at disabled learners and intended to provide a very brief overview of what they think of the technology rather than a systematic evaluation. This methodology may lead to the identification of factors to be evaluated in more detail.

The second methodology (section 5.6) is based on the simple classification methodology, appropriately modified to take account of the differences between classification and evaluation, plus four additional questions on comments and suggestions and an overall evaluation. Two versions of this methodology are presented. The first in section 5.6.1 is intended for 'experts' and involves purely a list of topics to be evaluated qualitatively, quantitatively or both with instructions. The second version in section 5.6.2 comprises a list of suggested questions to be used with disabled learners and other end-users.

The final methodology in section 5.7 is based on the detailed classification methodology appropriately modified to take account of the differences between classification and evaluation. This includes an additional section for evaluation of the impact on using the learning technology on motivation and ease of learning. This methodology is largely

intended to be used by expert evaluators and has therefore been left as a list of topics. However, specific questions could again be developed analogously to those in section 5.6.2.

Subsequently the term evaluator will be will be used subsequently for participants completing evaluation questionnaires and investigator for the evaluation organisers. As indicated in the principles it can be useful to investigate the relationship between the evaluations produced by different types of evaluators and personal and demographic factors, including age and disability status. A suggested list questions for obtaining evaluator data is presented in section 5.4

5.1 General Principles for Evaluating Inclusive ICT Based Learning Technologies and ICT Based Learning Technologies for Disabled Learners

Some general principles of evaluation of inclusive ICT based learning technologies and ICT based learning technologies for disabled students can be stated as follows:

1. Aims
   - 1.1 Clarity about the aims of the evaluation.
   - 1.2 Design of the evaluation to meet the aims.
   - 1.3 Appropriate trade-offs between thoroughness of evaluation and available resources, including the time and cognitive demands on learners, teachers and others involved in the evaluation.

2. Philosophy
   - 2.1 Evaluation approaches based on the social rather than the medical model of disability i.e. disability is considered the result of social, infrastructural, attitudinal and other barriers rather than an individual limitation arising from the person's impairment(s).
   - 2.2 Respect for all participants.
   - 2.3 Awareness of the importance of the following four factors; (i) the disabled learner or end-users, (ii) the context, (ii) the learning activities and (iv) the learning technology, though not all of them will necessarily always be considered in the evaluation.
   - 2.4 The importance of ethical issues, including providing all evaluators with full information on the aims and process of evaluation and use of the results, the right not to participate or to withdraw, confidentiality and safeguarding of personal data.
   - 2.5 Familiarisation with and following good practice in all aspects of evaluation, including confidentiality, ethical issues and health and safety.

3. Accessibility
   - 3.1 All aspects of the evaluation process need to be fully accessible to and appropriate for all participants.
   - 3.2 Asking all participants for their requirements in advance and ensuring they are implemented.
   - 3.3 'Normalising' the concept of having accessibility requirements.
   - 3.4 The rooms in which evaluation takes place need to be fully accessible and to meet the following requirements: (i) on ground level or choice of lift or stairs; (ii) close to wheelchair accessible toilets; (iii) any pictures, mirrors or clocks should be easily removable to avoid possibly disturbing sensory stimulation; (iv) all windows should have heavy blinds or curtains; (v) very quiet with good sound insulation and situated away from sources of noise such as road, lift, stairs, coffee machines, boilers and machinery; (vi) calm décor e.g. naturally coloured walls and carpet
   - 3.5 Communication: (i) investigators should face evaluators to allow lipreading, but be careful not to force eye contact; (ii) interpreters may be necessary and should be

briefed in advance on the topics and any special vocabulary; (iii) use of direct, unambiguous language; (iv) the level of language used should be tailored to the participants.

3.6 Documents: they should be available in alternative formats, which could include electronic, large print, black and white, easy read and sign language. The particular formats required will depend on the participants.

3.7 Length and breaks: the evaluation should be kept as short as possible. Longer evaluations should be divided into sections with short breaks between them. Some participants may require shorter sessions and longer breaks or to carry out the evaluation over more than one day.

3.8 Avoiding anxiety: (i) all participants should have full information and know exactly what is expected; (ii) frequent short breaks; (iii) investigators need to be alert to signs of anxiety and to provide support or end the session if necessary; (iv) availability of quiet room(s) for use in breaks.

4. Confidentiality and treatment of information

Learners (and others) need to know that

4.1 Their evaluation results will only be seen by the people carrying out the evaluation and not, for instance, by teachers, parents and social workers.

4.2 They are not being evaluated or assessed and that it is the technology (and possibly also the learning context) that are being evaluated.

4.3 There are no 'right' and 'wrong' answers.

4.4 There will be no negative consequences for them, for instance, due to particular answers, or performing badly in a test using the learning tool.

5. Process

5.1 Choice of appropriate (combinations of) methods which take account of the aims, available resources and deadlines. There is a very wide range of methods including questionnaires, interviews, focus groups, observation, action research and participant diaries.

5.2 In general, use of a combination of quantitative and qualitative indicators and, where feasible, both formative and summative evaluation.

5.3 Realistic expectations of the evaluation process and the associated difficulties.

5.4 Recognition that there is frequently a role for both simple quick and in-depth evaluations and the different types of results likely to be obtained.

5.5 The use of simple, clear unambiguous language, which is appropriate for the particular individuals involved in the evaluation.

5.6 Familiarisation with good practice and effective techniques for carrying out evaluations. There are a number of sources of information, including the Evaluation Cookbook (Harvey, 1998).

5.7 Where appropriate, repeated evaluation or evaluation throughout the life cycle, for instance in the case of learning technology development or procurement.

5.8 Where feasible, evaluation of both the technology in itself and in comparison to similar technologies.

6. Evaluators

6.1 The number of evaluators required for a particular evaluation and whether they should be, for instance, learners, teachers, experts or a combination, will depend on the aims of the evaluation.

6.2 Where feasible, the involvement of several different evaluators and, if appropriate, evaluators from different stakeholder groups and with different perspectives and experience.

6.3 In some circumstances it will be useful to use techniques such as convergent participation (Vargo et al, 2003) to obtain some degree of consensus. In others it

will be useful to examine the differences between the evaluations produced by different evaluators.

6.4 In the case of comparison of evaluations by different evaluators, it is useful to relate similarities and differences to personal and demographic data such as role (e.g. learner, teacher, expert, therapist), age, gender, disability status, accessibility requirements and years of experience and to obtain this data from the evaluators in order to do this.

6.5 Where the focus is on the impact on particular learners, the evaluation should involve those learners and possibly also teachers and other people working with or supporting them.

5.2 Principles for Evaluating Learning Outcomes

As already indicated, evaluating learning outcomes is not easy. It is complicated by the fact that using the learning technology can change or transform the context in which learning takes place or even the overall learning goals. It addition, it is difficult to determine which changes are due to the learning technologies and which to other factors. However, as already indicated, learning technologies are used in a particular context. Knowing that a technology gives positive learning outcomes in a particular context is a useful result, but cannot necessarily be generalised to other contexts.

A specific methodology or set of questions for evaluating learning outcomes will not be presented, since the most appropriate approach will largely depend on what is being assessed and the pedagogies and approaches to assessment in use in the institution, as well as other contextual factors.

There is a body of literature on assessing learning outcomes and the associated problems and uncertainties, for instance (Black & William, 1998; Boud & Falchikov, 2007; Boud et al., 1999). However, there has been less work on assessing learning outcomes for disabled students, though examples include (Fuller, Healey, Bradley & Hall, 2004; Ysseldyke & Algozzine, 1979). The whole process needs to be fully accessible and avoid restrictive assumptions which lead to requirements which some groups of disabled students are unable to meet or which disadvantage them.

A number of principles for evaluating learning outcomes using a particular technology will now be presented divided into (i) general principles, (ii) technology specific principles, and (iii) accessibility principles.

1. General principles
   - 1.1 Clear understanding of what learning outcomes are being assessed.
   - 1.2 Separate analysis of the behaviour and learning outcomes of different groups of learners, based on personal and performance factors, such as gender, attitude to learning, ‘successful’ learning and type of impairment or reasonable adjustments required.
   - 1.3 Recognition of potential conflicts of interest between the demands of rigorous evaluation and the requirements of learners. Rigorous evaluation may involve carrying out a controlled experiment, whereas learners require the best context and most appropriate tools to support learning.

2. Technology specific principles
   - 2.1 Recognition that learning takes place in a context and that it is rarely possible to separate the impact of the technology from other factors.
   - 2.2 Some of the impacts of the technology will be as a result of its influence on motivation and time spent learning.

2.3 New technologies may be more successful initially when they are seen as exciting than when they become mainstream. This may complicate their evaluation.

3. Accessibility principles:
   3.1 Full accessibility of the assessment location, documents provided, information and communication, including through the use of alternative formats and interpreters.
   3.2 Avoidance of unnecessarily restrictive pedagogical or other assumptions or requirements which lead to demands which some disabled learners cannot meet by reason of their impairment(s).
   3.3 Where possible, making the assessment procedure for all students accessible to disabled students rather than having different assessment procedures for disabled students.

5.3 Evaluation Aims

The aims of a particular evaluation process will generally depend on the context. A number of potentially useful evaluation aims are stated below, divided into the four categories of: (i) technology specific factors; (ii) technology development and improvement; (iii) user outcomes; and (iv) the wider context.

1. Technology-specific factors
   1.1 Evaluating the available accessibility features, including compatibility with assistive technologies, accessibility of all features, customisation options and the ability to easily switch features on and off.
   1.2 Comparison of different technologies which fulfil the same or similar functions, to provide learners and other users with information to make appropriate choices to best meet their needs.
   1.3 Reliability, ease of maintenance and upgrading and backward compatibility.
   1.4 Comparative or stand-alone evaluation of a group of technologies e.g. in a particular database.
   1.5 Ease of availability of both the technology and information about it and continuing long-term availability.
   1.6 Ease and suitability for adaptation, for instance to other languages, platforms (if not platform independent) and learning contexts and situations e.g. work, home and educational institutions.

2. Technology development and improvement
   2.1 Identifying gaps where there are no inclusive learning technologies and overlaps where existing technologies could usefully be combined.
   2.2 Evaluating technology performance (in a particular context) and identifying the need for improvements.
   2.3 Identifying the need for additional accessibility features and specifying them.
   2.4 Supporting the development of new and existing learning technologies by providing information on quality, effectiveness and the results of using specific solutions.

3. User outcomes I: evaluating the impact of technology use on:
   3.1 Removing barriers to learning and independent participation in learning activities
   3.2 Motivation, interest in learning and time spent learning.
   3.3 Self-confidence and self-image.
   3.4 The learning process and learning context.
   3.5 The achievement of pedagogical aims and learning goals (of different types), including long term learning/retention of knowledge, skills and understanding, and the ability to apply learning to real life situations.

User outcomes II:

3.6 Evaluating the suitability of a technology for a particular student.
3.7 Evaluating the benefits of a particular learning technology in terms of increasing the participation of a particular disabled learner or group of learners
3.8 Evaluating user satisfaction with a technology.
3.9 Evaluating the cognitive load of using the learning technology, ease and time taken to learn to use it effectively.

4. Wider context
   4.1 Evaluating the flexibility and range of features provided.
   4.2 Evaluating the initial and ongoing costs and value for money.
   4.3 Evaluating performance, satisfaction, functionality and other factors from different perspectives, including those of disabled learners, teachers (who may or may not be disabled), psychologists, therapists and other professionals, and the heads of educational organisations.
   4.4 Determining which technologies are most widely used and the reasons for this.
   4.5 Evaluating compatibility with other platforms and systems.

5.4 Evaluator Personal Data

The following questions can be used to obtain evaluator personal data to be used to correlate the outcomes of evaluation by different evaluators with their personal characteristics.

1. Are you?
Learner
Teacher
Educational expert
Therapist
Parent
Other please specify

2. Are you disabled?
Yes
No
If yes, state your disability or impairments

3. Do you have any particular accessibility or other requirements in order to participate in learning e.g use of a screen reader, keyboard with large keys or learning based on short tasks.
Yes
No
Unsure

If yes, please describe these requirements.

4. Are you?
Male
Female

5. What is your age?
Under 16
16-25
26-40

41-60
61-70
Over 70

6. If you are a teacher or other professional, how many years of experience do you have?
Less than 2 ___
2-5 ___
5-10 ___
10-20 ___
More than 20___

5.5 Simple Mainly Qualitative Evaluation Methodology

A very quick evaluation which takes only a few minutes can provide a useful overview of some of the main features of a technology. This quick evaluation can be carried out with different groups of end-users of the technology, for instance disabled learners and teachers. A suggested list of questions for use with disabled learners is given below. Most of the questions have deliberately been left open rather than suggesting answers to leave the choice of issues to the evaluators. However, they should be informed that this is intended to be a quick evaluation and that they long and detailed answers are not expected.

1. What do you like about the technology?
2. What do you not like about the technology?
3. What would you like to change about the technology?
4. Has the technology improved your motivation?
5. a. Is the technology helping you or making it easier for you to learn [add details of relevant topic, skill etc]?
   b. If yes, in what ways?

6. What is your overall evaluation of the technology from 0 (no good) to 5 (excellent)?

5.6 Simple Quantitative and Qualitative Evaluation Methodology

The features to be evaluated are based on a modification of the simple classification methodology to take account of the differences between classification and evaluation. Two versions are provided.

5.6.1 Expert Evaluation

In the case of expert evaluators, it may be sufficient to provide the list of features given below prefaced by the following instruction: 'Evaluate the following features. You should both describe the positive and negative factors of the technology in each category and evaluate if from 0 (the feature is not present) to 5 (full satisfaction with the feature).'

User features

1. The accessibility features provided
2. The cognitive and other demands on the user
3. Range of user characteristics technology is designed for.

Learning technology and user requirements

4. The range of learning activities supported
5. The appropriateness of any knowledge and skill requirements

Availability and use factors

6. Ease of availability with regards to cost and how it can be obtained.
7. Ease and intuitiveness of use by disabled learners
8. Reliability, including the length of time the technology can be used without replacing batteries.

Additional comments, improvements and overall evaluation

9. Provide any additional comments
10. What features could usefully be improved
11. Give suggestions for improving these features
12. Give an overall evaluation of the tool from 0 (worthless) to 5 (excellent).

5.6.2 Sample Questions for End-Users

In the case of disabled learners, parents and other end-users a detailed list of questions will be required to investigate each feature. The following is a list of suggested questions.

1. The accessibility features provided:
   i. Does the tool provide all the accessibility or other features you need to use it easily?
      Yes
      No
      Unsure

   ii. Do you experience any barriers to using the tool?
      Yes
      No

      If yes, please describe any barriers you experience.

2. The cognitive and other demands on the user
   i. Does using the technology require you to remember a lot of information (in addition to that required by your course)?
      Yes, generally
      Yes, sometimes
      Rarely
      Never
      Unsure

      If yes, do you find this difficult?
      Yes, generally
      Yes, sometimes
      Rarely
      Never
      Unsure

   ii. Does using the tool require you to do a lot of things at one time?
      Yes, generally
      Yes, sometimes
      Rarely
      Never
      Unsure
      If yes, do you find this difficult?

Yes, generally
Yes, sometimes
Rarely
Never
Unsure

iii. Does using the tool require you to think a lot or in ways that you find difficult?
Yes, generally
Yes, sometimes
Rarely
Never
Unsure

3. Range of user characteristics technology is designed for.

i. Is the technology suitable for you?
Very suitable
Suitable
Moderately suitable
Unsuitable
Very unsuitable

ii. If the technology is not suitable for you, indicate all of the following which hold:
Too young for you
Too old for you
For someone for the other sex i.e. male if you are female, female if you are male
Not easy to use for some with my impairments/disabilities
For people from a different country or culture from me
Other please state

iii If you have answered part ii, please explain your answer

4. The range of learning activities supported
i. What learning activities have you used the technology for?

ii. Are you are aware of learning activities that the tool is not suitable for?
Yes
No
Unsure

iii. If yes, please provide details

iv. What do you think of the range of learning activities the tool can be used for?
Very good
Good
Ok
Limited
Very limited

5. The appropriateness of any knowledge and skill requirements
i. Did you have to learn any new information or skills in order to use the technology?
Yes
No
Unsure
ii. If yes, please specify

iii. What existing knowledge and skills did you draw on when using the technology?

iii. Do you think that the knowledge and skills required to use the technology could be reduced e.g. by making it less complicated?
Yes
No
Unsure

6. Ease of availability with regards to cost and how it can be obtained.
   i. How were the costs of the technology covered?
   It was free
   I paid for it myself
   I obtained funding
   I do not own the technology

   ii. If you paid for it yourself, was this because?
   It was not expensive, so not worth applying for funding
   As far as I know I am not entitled to funding
   I did not know where to apply
   My application for funding was rejected
   Other Please state

   iv. If you obtained funding,
   a. What organisation did you obtain it from?

   b. How easy was it to apply for funding?
   Very easy
   Easy
   Neither easy or difficult
   Difficult
   Very difficult

7. Ease and intuitiveness of use by disabled learners
   i. How easy was it to learn to use the technology?
   Very easy
   Easy
   Neither easy or difficult
   Difficult
   Very difficult

   ii. How long did it take you to learn to use basic features of the technology

   iii. Do you use the more advanced features of the technology?
   Yes, frequently
   Yes, sometimes
   No
   There are not any advanced features

   iv. If you do not use the more advanced features, is this because?
   You do not need to use them
   You do not have time to learn to use them
   You have found it difficult to learn to use them
   Other

8. Reliability, including the length of time the technology can be used without replacing batteries.
   i. Do you feel you can rely on the technology?
      Yes
      No
      Unsure

   ii. How long have you had the technology?

   iii In this time, how often have you experienced problems with the technology that you could fix easily yourself?

   iv. In this time, how often have you experienced problems with the technology that you needed someone else to resolve?

   v. When problems needed someone else to resolve, how long did this take?

   vi. If the technology uses batteries, how long can you use the technology before the batteries need changing or recharging?

5.7 Detailed Evaluation Methodology

The following evaluation methodology is based on the detailed classification methodology with modifications to take account of the differences between evaluation and categorisation. Both qualitative and quantitative evaluation can be used, with a scale from 0 (feature to absent) to 5 (feature is fully present or excellent) suggested. Detailed questions could be used with this form of evaluation, as illustrated in section 5.6.2 but will not be presented here.

A Disabled learner or end-user

1. Accessibility features provided
   1.1 The extent of compatibility and usability with assistive technology eg. screen readers, keyboard with shortcuts, switch or other keyboard emulation and pointing device(s)
   1.2 Provision of text representations of visual and audio features, magnification and/or options to choose the colour of text and background
   1.3 The extent of the cognitive and other demands and memory requirements,
   1.4 Provision of sign language or other communication support
   1.5 The ability to turn stimulation e.g. visual and sound effects, colour, scrolling text, animation on and off, with the non-stimulation option the default.
   1.6 The extent of accessibility of features for teachers and experts, including course creation, administration and editing.

2. Appropriateness of skill requirements e.g. none that are unnecessary or excessively demanding for the level and type of learning.
   2.1 Literacy, numeracy and language skills
   2.2 Computer/IT skills
   2.3 Background/general knowledge or other skills
   2.4 Physical skills to use the tool or technology
   2.5 Subject specific knowledge

3. Design to take into account user diversity
   3.1 Consideration of age related factors and age appropriateness

3.2 Consideration of gender and any differences in requirements based on gender.
3.3 Consideration of cultural factors, the needs of different cultures and, in particular, the culture of the main target audience(s)
3.4 Consideration of different approaches to learning, particularly of the main target audience(s)
3.5 Consideration of educational background and experience, particularly of the main target audience(s)

B Learning Technology

4. Type of technology
   4.1 Flexibility e.g. platform independent or compatibility with a range of different platforms
   4.2 Range and appropriateness of the facilities provided by the technology

5. Interface
   5.1 Compatibility with different types of input and output e.g. mouse and keyboard, screenreader, Braille keyboard (input); screen/visual display, Braille display, speech (output).
   5.2 The amount of training required to use the interface and whether this is appropriate for the facilities provided
   5.3 The diversity of the user groups it is suitable for and the appropriateness of any restrictions.
   5.4 Availability of customisation options
   5.5 Range of languages supported

6. Use/availability factors
   6.1 Cost
   6.2 Ease of availability
   6.3 Reliability and robustness
   6.4 Battery life and ease of recharging

7. Technical factors
   7.1 Compatibility with and ability to import and export data from other software e.g. Microsoft office or libre office
   7.2 Compatibility with different operating systems
   7.3 Lack of restrictiveness of memory and other technical requirements
   7.4 Availability of accessible documentation such as user manuals, training, on-line help and helpline
   7.5 Cost and frequency/difficulty of maintenance/updating requirements

C Context

8. Requirements
   8.1 Ease of setting up
   8.2 The extent of compatibility with different, including older versions of hardware and software

9. Flexibility and appropriateness of contextual requirements:
   9.1 Support for a/synchronous and on/off line learning or the appropriateness of any restrictions.
   9.2 Support for individual, group, teaching supported learning and learning communities or he appropriateness of any restrictions. .

9.3 Extent of flexibility or appropriateness of restriction to a particular type of learning e.g. use in vocational, re/training, rehabilitation, qualification-related education and/or informal learning

D Learning Activity/ies

10. Other
    10.1 The extent of learner control of confidentiality

E Additional Person Specific Factors

E1 Impact on attitude and ease of learning
- E1.1 Change in motivation
- E1.2 Change in self-confidence
- E1.3 Change in self-perception as a learner
- E1.4 Change in self perception as a disabled person
- E1.5 Change in enjoyment of learning
- E1.6 Change in ease of learning

6. Discussion and Conclusions

This deliverable has presented the first (systematic) frameworks for classifying and evaluating ICT-based learning technologies for disabled learners and inclusive ICT- based learning technologies. Classification is about putting learning technologies into categories so that different types of learning technologies can be distinguished from each other and their main features are clear. Evaluation of a learning technology is about making value judgements abut it, either in general or about particular features.

These frameworks were developed as part of a multiple stage process. The initial methodologies were developed by the workpackage leader using input from the network partners to a worksheet and questionnaire and the categories in the Comprehensive Assistive Technology (CAT) Model (Hersh and Johnson, 2008ab). Input to the evaluation framework was also obtained from members of the End User Advisory Committees and other contacts outside the project. The frameworks were further developed, modified and validated in response to small group discussion by the partners at a project meeting in Glasgow, partner comments and comments arising from applying the methodologies to very varied technologies in use in the different partner countries.

The classification framework comprises three different classification methodologies. The first is a very detailed methodology based a modification of the CAT model. It has the four high level components: disabled learner, learning technology, context, learning activity/ies and two further levels of classification from each component. The second classification methodology is a simple methodology comprising nine criteria divided into three groups of three with the top-level headings of disabled learning, learning technology, and availability and user factors. The third methodology is a classification of the personal and contextual factors that affect the use of learning technologies. Thus the first two methodologies describe the technology, whereas the third methodology describes factors relating to the end-user and their context and can be used to determine the characteristics of the end-users a particular technology is suitable for and the types of technologies that are suitable for a particular end-user.
Evaluation frequently involves a process rather than a one-off determination by one or more experts. The evaluation framework comprises sets of principles and aims for evaluating

inclusive learning technologies and learning technologies for disabled learners and three different methodologies. To support investigation of the relationship between evaluator characteristics and evaluation results a series of questions for obtaining relevant evaluator personal data has also been presented.

The principles are divided into those that hold for evaluation in general and those that are specific to evaluating learning technologies. The contribution of evaluation of learning outcomes to the overall evaluation of a learning technology is recognised. A set of principles rather than a methodology is provided in this case, as the details will depend on the outcomes being assessed and the assessment practice and pedagogies of the institution carrying out the assessment/evaluation. In addition, it is complicated by the difficulties in separating the impacts of a learning technology on learning outcomes from those of other factors.

The first methodology presented is intended to provide a very simple and quick overview of the features the technology end-users, particularly disabled learners, like, dislike and would like to change. This overview may highlight features for further evaluation. Most of the questions are open to enable evaluators to raise the issues they are interested in without direction from the investigators.

The other methodologies are based respectively on the simple and detailed classification methodologies with modifications to take account of the differences between classification and evaluation. The simple methodology has an additional section for general comments, suggestion for changes to the technology and overall evaluation. The detailed methodology has an additional section on changes in user attitudes, such as motivation and self-confidence, and ease of learning. Both these methodologies could be used for either quantitative or qualitative evaluation or a combination of the two. In the case of the simple methodology a list of questions for evaluation by end-users, particularly disabled learners, is presented. Similar questions could be developed for the detailed methodology, but are not presented here.

These frameworks will have a number of very useful applications. In particular they provide the first clear framework for discussion, classification and evaluation of existing ICT-based learning technologies for disabled people, the identification of gaps in provision or the need for modifications of existing technologies and support for the design and development of new technologies, They will also have applications in identifying the characteristics of the (groups of) learners particular learning technologies are most suited to, as well as enabling better use to be made of existing technologies and the best choice of technologies for a given disabled learner or group of disabled learners.

The methodologies can also be used to support the determination of good practice and identification of the various national, legal, regional and other factors required to support it. They can further play an important role in informing policy, including in determining the future research agenda.

Although the methodologies are aimed specifically at learning technologies for disabled students and inclusive learning, they also have applications to learning technologies for non-disabled students. There are also potential applications of modifications of the approach to other types of uses of ICT.

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Appendices

Appendix 1 Workpackage 3 Work Sheet

The use of learning technologies by disabled adults could be considered to involve a person (the disabled adult) who uses a learning technology in a particular situation or context to carry out learning activities.

This gives four factors:
The person
The learning technology
The context
The learning activity.

In answering the questionnaire you should consider the technologies and any case studies you have collected. and your knowledge of the use of learning technologies by disabled adults.

Section A Generation of Factors

1a. Do you think there are any other factors that should be added to this high level description?
Yes___
No____
Unsure___

If yes, please specify these factors. As well as providing a name, it might be helpful to give a brief description
b. Comment on these additional factors

2a. Give a list of the most important factors required to characterise or describe the person/disabled adult using a learning technology
b. Give a list of other factors which complete the characterisation or description, but which are less important.
c. Comment on the factors chosen under a and b

3a. Give a list of the most important factors required to characterise or describe the context they are using the learning technology in.
b. Give a list of other factors which complete the characterisation or description, but which are less important.
c. Comment on the factors chosen under a and b

4a. Give a list of the most important factors required to characterise or describe a learning technology.
b. Give a list of other factors which complete the characterisation or description, but which are less important.
c. Comment on the factors chosen under a and b

5a. Give a list of the most important factors required to characterise or describe the learning activity.
b. Give a list of other factors which complete the characterisation or description, but which are less important.
c. Comment on the factors chosen under a and b

If you have provided additional factors please answer question 6 for each of these additional factors.

6a. Give a list of the most important factors required to characterise or describe the
b. Give a list of other factors which complete the characterisation or description, but which are less important.
c. Comment on the factors chosen under a and b

7. Please provide any additional comments

Section B Structuring of Factors

A list of factors is awkward to use. Therefore this section is looking at possible structures for the factors. The choice of type of structure is up to you. This includes the relationship between the main and other factors

Please provide a structure for the factors describing

1. Disabled adult

2. Context

3. Learning technology

4. Learning activity

5. Any other factors

6. Comment on the structure for
a. Disabled adult

b. Context

c. Learning technology

d. Learning activity

e. Any other factors

f. Whether you have chosen to use the same or different approaches to providing a structure for each of these factors.

7. Please provide any additional comments

C Fitting Your Model to Your Technologies and Case Studies

Choose three of your technologies and/or case studies. Please answer the following for each of these technologies or case studies.

1. Fit the model based on the structure to the technology as it is used or case study and describe this fit, including e.g. the values taken by different factors.

2. Comment on features of your model that work well.

3. Comment on any redundant features of your model

4. Comment on any factors or features of the technology and its use that are not described by the model.

5. Provide suggestions to improve your model.

5. Any additional comments.

Appendix 2: Questions on Evaluation

1. What do you think the main aims of evaluating inclusive learning technologies should be?

2. What do you think are the main factors that should be evaluated?

3. How do you think the evaluation process should be carried out?

4. How do your answers relate to the theories of evaluation?*

* For partners with knowledge of evaluation theories.

Appendix 3 Sample Questions to Use with Section E of Detailed Evaluation Methodology

1. Motivation
   1.1 How motivated to study were you [in general, particular subject or topic] before you started using the learning technology?
   Very motivated
   Motivated
   Slightly or sometimes motivated
   Unmotivated or negative about studying
   Very unmotivated or very negative about studying

   1.2 a. Has using the technology changed your motivation to study?
   Yes
   No
   Unsure

   b. If yes, has your motivation?
   Increased a lot
   Increased a bit
   Decreased a bit
   Decreased a lot

   1.3 Please comment on how the technology has affected your motivation

2. Self-confidence
   2.1 How self-confident did you feel in general before you started using the learning technology?
   Very self-confident
   Self-confident
   Slightly or sometimes self-confident
   Lacking in self-confidence
   No self-confidence at all

   2.2 a. Has using the technology changed how self-confident you generally feel?
   Yes
   No
   Unsure

   b. If yes, do you generally feel?
   A lot more self-confident
   A bit more self-confident

A bit less self-confident
A lot less self-confident

2.3 Please comment on how the technology has affected your self-confidence

3. Self-perception as a learner

3.1 What did you feel about yourself as a learner before using the learning technology?
Very successful learner
Successful learner
Sometimes successful, sometimes not
Successful at some subjects, not at others
Unsuccessful learner
Very unsuccessful learner

3.2 a. Has using the technology changed what you feel about yourself as a learner?
Yes
No
Unsure

b. If yes, has it made you (generally) feel?
Much more successful
More successful
Less successful
Much less successful

3.3 Please comment on how the technology has affected what you feel about yourself as a learner

4. Self-perception as a disabled person

4.1 What did you feel about yourself as a disabled person before using the technology?
Wonderful
Good
Ok
It varies
Inadequate
Totally inadequate
Other please state

4.2 a. Has using the technology changed what you feel about yourself as a disabled person?
Yes
No
Unsure

b. If yes, has it made you (generally) feel
Much better
Better
Worse
Much worse

4.3 Please comment on how the technology has affected what you feel about yourself as a disabled person

5. Enjoyment of learning
   5.1 Did you enjoy learning before using the technology
   Yes, a very lot
   Yes, a lot
   Sometimes or some subjects only
   No
   No, I hated it
   Other please state

   5.2 a. Has using the technology changed how much you enjoy learning?
   Yes
   No
   Unsure

   b. If yes, do you (generally) now enjoy learning
   Much more
   More
   Much less
   Less

   5.3 Please comment on how the technology has affected your enjoyment of learning

6. Ease of learning
   6.1 How easy did you generally find it to learn before using the technology?
   Very easy
   Easy
   Sometimes easy, sometimes difficult
   Some subjects easy, some difficult
   Difficult
   Very difficult

   6.2 a. Has using the technology changed how easy it is for you to learn?
   Yes
   No
   Unsure

   b. If yes, it is now generally?
   Much easier to learn
   Easier to learn
   More difficult to learn

   6.3 Please comment on how the technology has affected how easy it is for you to learn?

Appendix 4 Glossary of Abbreviations

CAT: Comprehensive Assistive Technology (model)
HAAT: Human Activities Assistive Technology (model)
ICT: information and communication technology
SETT: Student, Environment, Tasks and Tools (model)
WCAG: Web Content Accessibility Guidelines
WCAG 2: Web Content Accessibility Guidelines version two
W3C: World Wide Web Consortium

Appendix 5 Changes in this Version

This version has been updated in the following ways:

1. Reformulation of Section E of the detailed classification methodology as a separate methodology for classifying personal and contextual factors which affect the use of learning technologies.
2. Consolidation of the evaluation methodologies into three methodologies.
3. Making an edited version of the previous methodologies for evaluating the impacts on motivation and self-confidence and ease of learning an appendix of sample questions to be used with Section E of the Detailed Evaluation Methodology on impacts on attitudes and ease of learning.
4. Editing to ensure consistency as a result of these changes and to improve readability.