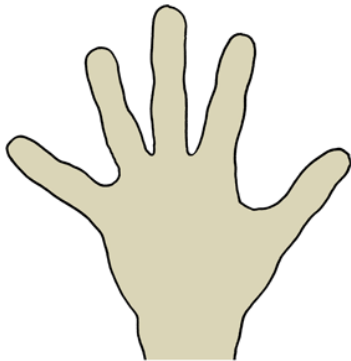


# PROJECT DELIVERABLE

<p><b>Grant Agreement number:</b> 224216</p> <p><b>Project acronym:</b> HANDS</p> <p><b>Project title:</b> Helping Autism-diagnosed teenagers Navigate and Develop Socially</p> <p><b>Funding Scheme:</b> Collaborative Project</p>	
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## Deliverable description

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Work Package No:	6
Lead beneficiary:	London South Bank University
Authors:	<p>Editing and Collation: Joseph Mintz, Cristina Devecchi</p> <p>Contributing Authors from ELTE/AF: Miklos Gyori, Krisztina Gy. Stefanik. Ildikó Kanizsai-Nagy</p> <p>Contributing Authors from AAU: Morten Aagaard, Henrik Scharfe</p> <p>Contributing Authors from LSBU: Joseph Mintz, Cristina Devecchi, Stephen Lerman, Caty March</p>
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**Summary:**

This document presents the overall framework for the evaluation and testing of the HANDS ICT Tool Prototype 1. It includes the strategic level research aims, timeline, procedures for recruitment and subject selection, data collection, data storage, procedures to ensure confidentiality, anonymity and appropriate consent, as well as the specification of proposed tests and evaluations in the three project academic streams – Cognitive Psychology, Persuasive Technology and Applicability in the Learning Environment. Contributions have been received in this respect from ELTE University (Cognitive Psychology) and Aalborg University (Persuasive Technology).

Significant aspects of this document are drawn from prior deliverables:

Project Deliverable Document D3.2.1 Implementation and Evaluation Guide for ALE (LSBU)

Project Deliverable Document D2.1.1 Report on test methodology and research protocols (Cognitive Psychology) (ELTE/AF)

Project Deliverable Document D4.1.1 Report on test methodology (Persuasive Technology) (AAU)

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## **1.0 Introduction**

The HANDS project is a multi-disciplinary project aimed to develop a mobile ICT solution to help young people with an autism spectrum diagnosis (ASD) to become better integrated in society. The overall main objective is to develop a set of software programmes (referred to as ICT Tools) on smartphone mobile technology to assist children and young people (ages 11 to 16) on the autistic spectrum to develop social skills ability in particular social situations that present them with difficulties. The project is formulated as a European Commission (EC) Framework Seven Project, as part of the Accessible and Inclusive ICT section of the framework. Based on new research from Human-Computer Interaction (HCI) and persuasive technology in particular, cognitive psychology and neuropsychology, and educational theory and practice on ICT impact on teaching and learning, and provision for children with learning difficulties and/or disabilities, the mobile ICT solution will support children in handling situations where they have to act autonomously, as well as to develop their social skills and self management skills. Besides these overall aims, the HANDS project strives to develop a set of software components based on Persuasive Technology which meet five important objectives, and they are:

- a) An efficient tool for the young person to improve social skills and self management skills or manage social activities,
- b) An efficient tool for the teachers to design and customise the tools for the young person,
- c) An efficient tool for the teachers to measure the progress of the improvement in the social skills and self management skills,
- d) The creation of a software design which makes exchange of experiences and software components easy,

HANDS aims to provide a Proof of Concept test as to whether Persuasive Technology in a mobile ICT toolset can be a solution to the problem of helping autism-diagnosed teenagers handling daily challenges. The possibility of a valid proof is ensured through a), a very high level of user participation, having 4 different schools located in Hungary, Sweden, Denmark and the UK, and organizations conducting teaching of autism diagnosed teenagers in the project, and b) a multi-method cross case approach to evaluation. The project has also a great amount of entrepreneurship present through two industrial partners, who can facilitate bringing the resulting products out to end users Worldwide. This will contribute to strengthening the European position in inclusive ICT.

The HANDS project will run over three years from June 2008 to May 2011. It follows a software development cycle as follows:

- Specification of Functionality for Prototype 1
- Development of Prototype 1
- Implementation and Evaluation of Prototype 1, feeding in to:
- Specification of Functionality for Prototype 2
- Development of Prototype 2
- Implementation and Evaluation of Prototype 2
- Review and Dissemination

- **The Project Partners**

The partners within the consortium are:

- **Aalborg University**, Denmark (Lead Institution and lead for Persuasive Technology)
- **Wirtek A/S**            **WIDK**        Denmark (SME - Software Development)
- **Wirtek S.R.L**        **WIRU**        Romania (SME - Software Development)
- **Edvantage**            **EDV**        Norway (SME – Software Development)
- **Eötvös Loránd University** (ELTE), Hungary (Lead for Cognitive Psychology)
- **London South Bank University** (LSBU), UK (Lead for Applicability in the Learning Environment)
- **Helen Allison School**, constituent school of the National Autistic Society, UK (Test Site School)
- **Aalborg Kommune** (Egebakken), Denmark (Test Site School)
- **Svedenskolan**, Sweden (Test Site School)
- **Autism Foundation**, Hungary (Test Site School)

- **Structure of the Document**

This document includes the following sections:

- Overall Evaluation Framework, indicating key cross-project issues
- Further Specific Details on Cognitive Psychology Evaluation (ELTE University)
- Further Specific Details on Applicability in Learning Environment Evaluation (LSBU)
- Further Specific Details on Persuasive Technology Evaluation (Aalborg University)

The document outlines the methodology to be applied to the evaluation of Prototype 1 to be undertaken during the school year 2009-10. Although reference is made in outline to

Prototype 2 evaluation, this is not discussed in detail. It should be noted that the results from the Prototype 1 evaluation will be used to develop and refine the planned Prototype 2 evaluation. Accordingly, further documents relating to Prototype 2 are scheduled for later in the project cycle.

The proposal summarises the research proposals of the three research partners (LSBU, AAU and ELTE), outlines the methods to be used, highlights ethical implications and proposed ways of ensuring confidentiality, storage and handling of data, issues of consent/assent, and approaches to minimising risks and psychological and/or emotional harm to the children, parents and teachers involved in the research.

- **Evaluation/Research Objectives for Prototype 1 Overall Evaluation Framework.**

The key evaluation/research objectives for this phase of the project are to evaluate:

1. the effect of the introduction of an ICT tool based on persuasive technology in developing the children's social skills, self management skills and social integration
2. the applicability of the ICT tool to the learning environment – i.e. how it fits in with existing practices of teaching and learning AND what impact it has on such practices
3. gaining feedback on the development, improvement and overall technical assessment of the ICT tool and elucidating recommendations for functional changes for Prototype 2

- **Relevant Documents**

This document builds on a number of relevant previous documents. It is recommended that these are referred to as follows:

EU Seventh Framework Programme "Helping Autism-diagnosed teenagers Navigate and Develop Socially" Appendix 1 Approved by EU

Project Deliverable Document D3.2.1 Implementation and Evaluation Guide for ALE

Project Deliverable Document D2.1.1 Report on test methodology and research protocols (Cognitive Psychology)

Project Deliverable Document D4.1.1 Report on test methodology (Persuasive Technology)

LSBU Ethics Committee Application June 2008 "Helping Autism Diagnosed Young People Navigate Socially (HANDS) Project – Phase 1".

LSBU Ethics Committee Linked Summary Research Proposal June 2008 "**Research Proposal** - Helping Autism Diagnosed Young People Navigate Socially (HANDS) Project – Phase "[The two previous documents outline the technology aspects of the ICT tool and the specific functions, including the CoMe]

## 2.0 Overview of the HANDS Evaluation Framework

- **1. Background and rational**

While the overall rationale for the project is that of developing an ICT tool able to support children with ASD, the rationale for the methodologies applied to the evaluation of Prototype 1 stem from the interests of the three academic partners. The multidisciplinary approach requires the integration of both qualitative and quantitative methods of data collection and analysis. This mixed-method approach while challenging has the advantage of offering a more in depth and rich analytical framework for understanding and evaluating the use of mobile technology for children with ASD.

### *Cognitive Psychology*

Cognitive psychology represents a crucial level of scientific understanding of autism/ASD, as an *interlink between brain and behaviour*, between neuro-developmental anomalies and atypical behaviours in autism/ASD [Morton, 2004]. State-of-the-art understanding of the cognitive characteristics of autism, based on about 40 years of systematic research, reveals a threefold core impairments (for summary reviews, see, e.g., Frith, 2003, Gyori, 2006):

(1) Impairment in the so-called *naïve theory of mind ability* (Baron-Cohen, 1995; Baron-Cohen & Frith, 1985), a fundamental human cognitive ability to understand, explain and predict actions by attributing mental states to the acting agent.

(2) Impairment in the so-called *executive functions* (Ozonoff, Pennington, Rogers, 1991; Russell, 1997), a fundamental human cognitive ability to organise one's own cognition and actions in order to set up and reach distant goals by flexible behavioural strategies.

(3) Impairment in the so-called *central coherence* (Frith, 1989; 2003), a human cognitive ability to organise the incoming information into meaningful and coherent patterns in a context-sensitive manner.

As social transactions are quite complex situations requiring these abilities, all these impairments contribute to the social isolation and marginalisation of people with autism/ASD. Moreover, beyond these core impairments, it is now well-documented that there are other, in a sense more subtle cognitive impairments in autism/ASD, which contribute to several symptoms to a varying degree. These involve *sensory-perceptual anomalies and specific patterns of the functioning of memory, attention, motor control and language*.

Current psychological and pedagogical practice both in intervention and in support builds heavily on this knowledge on the cognitive background of autism/ASD. Current research is to a large extent aimed at clarifying the precise relationship between these impairments, their more accurate testing throughout the life-span, and designing more effective intervention methods to improve these abilities and social, communicative and self-management skills based on them.

Within the project, Cognitive Psychology presents both a basis for understanding autism and a scientific approach, using quantitative methods, to evaluating the effectiveness or otherwise of the mobile ICT tool. In particular, it will represent the first attempt to *design and run a quantitative test based on the science of psychology on the value and efficiency of intensive use of mobile ICT tools for improving social competence and integration in an impaired population, thus decreasing the risk of their social isolation and marginalisation*. In doing so, it will build on considered best practice for *intervention research studies on social skills development in ASD*. (e.g. Williams White et al, 2007; Rao et al, 2008; Rust and Smith, 2006; Smith et al, 2007).

### ***Applicability in the Learning Environment (ALE)***

The rationale for focusing on how the HANDS ICT tool is applicable to the learning environment is located in the extensive and growing body of educational research, which has reported on the positive benefits of ICT and emerging technologies on teaching and learning. While this body of the research is still mainly focused on traditional technologies (desktops, laptops and various educational software), there is also an emerging field interested in the application of mobile technology, in particular PDAs and mobile phones.

Briefly, research shows that the integration and use of technology has the following benefits on students' learning (Cox, et al., 2003; BECTA 2002, 2007a, 2007b):

- Raising attainment
- Increase children's **motivation**

- Improve **writing** and **presentation skills**
- Support and foster children's **imagination** and **creativity**
- Enable a faster and easier **manipulation of data**
- Facilitate **communication, social interaction** and **collaboration**

Findings are, however, less unanimous and conclusive on the whether technology also raises standards of attainment. Research therefore stresses the importance of locating the use of technology in context, and thus the evaluation of technology requires taking into account a number of factors as follows:

- Variety of technological products on the market and speed of innovation (Oblinger, 2008);
- Mismatch between technological innovation and schools and teachers' capabilities and competencies (van't Hooft, 2008)
- Growing divide between children's use and technological capabilities and those of the teachers (Prensky, 2008)
- Individual learners' characteristics such as computer experience, gender, ability and age (Lou *et al*, 2001).

A similar, but also different scenario is portrayed by research that has focused on the use and benefits of technology for children with disabilities and/or learning difficulties. The use of technology in this area can be classified according to six purposes (Florian, 2004):

- Tutoring;
- Exploration;
- Assistance;
- Communication;
- Assessment;
- Management purposes.
- 

With regard to the use and application of technology and its benefits for learning, the literature on ICT and autism reports similar outcomes to the one already reviewed. While mindful of the possibility that the use of technology can become obsessive, Hardy (2000) suggest that learners with ASD show interest and engagement with computers which can impact on their sense of achievement, self-efficacy, and can increase their self-esteem and integration. According to Hardy, such positive outcomes are the result of five computer and technology quality, and they are:

- Automaticity;
- Capacity;
- Provisionality;



- Interactivity; and,
- Sociability.

These qualities are also supported by Gyori, et al.'s (2008) review who list the following advantages of technology:

- It works in a consistent and predictable way;
- It provides a comfortable and rewarding environment;
- It raises less social demands;
- It allows the learner to control the pace;
- It allows for mastery learning through repetition;
- It is a visually-based medium;
- Mobile technology in particular is culturally accepted

They also warn about possible problems of technology in general and the use of smartphones in particular, such as:

- Dependency
- Maladaptive attachment
- Accessing dangerous or inappropriate websites
- Putting unreasonable high level of responsibility on learners and their parents

The ALE research proposal, therefore, contributes to the overall project by locating the use of the new technology within relevant research and by supporting the other two research proposal by adding to the evaluation the practical pedagogical aspect of technological implementation and application.

### *Persuasive Technology*

Persuasive Technology, also referred to as 'captology', is a new research field invented by the Stanford psychologist, B. J. Fogg (2003). Persuasive Technology seeks to combine insights into various aspects of computing technology with insights theory on persuasion. In the HANDS project, we understand Persuasive Technology to be a specialisation with ICT studies, emphasising the persuasive role that interactive computer systems can embody. Captology as envisioned by B.J. Fogg in his 2003 book relied heavily on experimental psychology, and in some parts rhetoric, to frame the notion of persuasion. Persuasive Technology then becomes the attempt to work on people's attitude, behaviour or both, through technology. The use of Persuasive Technology lends an understanding of the value of ICT as persuader and meta-level advisor, thus framing the design of the proposed ICT tools to have the highest degree of persuasive efficiency.

A central concept in Persuasive Technology is that humans have unique properties as persuaders and so does technology. These persuasive properties are distinct between the two groups, yet when they are utilised together they create a strong synergy of persuasive activities (Fogg, 2003).

Persuasive Technology focuses on many of the same issues that are considered within the broader research field of Human Computer Interaction, including: users need, user-oriented methods and technology which match the user need. In fact, Fogg's seminal 2003 book strongly emphasises an HCI perspective on technology, specifically the key focus is on one property: the persuasiveness of the technology. Whilst the overall goal of HCI is to *"...create user experiences that enhance or augment the way people work, communicate and interact"* (Preece, J., Rogers, Y. & Sharp 2007, p11), the overall goal of Persuasive Technology is far more focused on *"... design, research, and analysis of interactive computer products created for the purpose of changing people's attitude or behaviour"* (Fogg, 2003: 5). In more recent work, such as (Fogg 2008), the focus has shifted from HCI to Computer-mediated Communication (CMC). Under this view, computing technology is seen as carrying, shaping and promoting human communication. The focus thus shifts from the individual and a machine, to communicating parties connecting through computers. It is quite obvious that interface studies, and more specifically: interaction design, are vital keys to successful implementations of ICT in these contexts. Therefore it is important to facilitate a fruitful cooperation between the software developers Wirtek DK and Rumania, and Edvantage Group, the latter being responsible for the interaction design. But it is equally obvious that the HANDS software will be situated in the fragile situation of trust and communication between a child with an autism-diagnosis and his teacher. The implication is that from a CMC perspective, it becomes very important to focus on the teacher – child interaction, and the effect that the software has on that interaction. To a large extent, the HANDS software is developed in the tradition of participatory design, and what is commonly known as the Scandinavian tradition of systems development. This means that strong emphasis is given to actual praxis in the context for which the software is designed.

When designing technology based on Persuasive Technology, there is also a focus on understanding to what extent an inner motivational basis for attitude or behaviour change exists. This is often an overlooked prerequisite in traditional software development methodology. Furthermore, to be persuasive, the technology has to have credibility in order to be convincing.

The development of a mobile ICT solution for children with autism based on Persuasive Technology is the key innovative feature of the HANDS project. As such, the project offers an opportunity to see how this technology can be appropriately applied in the context of

the specific motivational structure of children with autistic spectrum disorders. Further, addressing the specific ethical issues related to the use of Persuasive Technology with children with autism is at the core of the project and is referred to in detail in this document. Further, the HANDS project is set up with a specific workpackage on ethical issues, and this includes the setting up of an Ethical Board (EB), who will review the ongoing work of the project from an ethical standpoint. The EB's members are independent of the consortium partners.

- **2. Study Components**

The following section details the features of the overall evaluation design. In so doing, the report focuses both on the way in which we integrate different research proposals; implement the research over four countries, and, finally, the solutions put forward to maintain ethical clarity and purpose.

The HANDS project represents one of the few attempts *to integrate knowledge and expertise cross-disciplinary* from cognitive psychology, pedagogical intervention, and (mobile) ICT to develop and test a new tool for increasing the social integration of a group with a high risk of isolation and marginalisation. Further, as detailed below, the evaluation framework for the HANDS project represents a mixed-method testing methodology, which uses *a variety of the methods – quantitative and qualitative* in a parallel and integrated way. Thus, the HANDS project is firmly located in a growing field of interdisciplinary research. It has the potential of advancing knowledge on how technology can improve young people with autism's opportunities to be socially included, but it also has the opportunity to advance our understanding of how mobile technology can help teaching and learning in general.

The multidisciplinary and collaborative process of user engagement in all stages of the research is also an innovative feature of the project and one that has been supported generally as necessary to understand and draw conclusions on complex practices such as pedagogy and technology (Burke-Johnson and Onwuegbuzie, 2004; Orlikowski and Baroudi, 1991). As Chatterji (2006) suggests, the rationale for employing a mixed-method approach and in particular a qualitative approach, resides in the fact that 'in depth and often site-specific studies of context variables, along with systematic examinations of programs inputs and processes as potential moderators and intervening factors, are a *necessary prerequisite* to both designing and implementing sound field experiments geared towards answering causal questions on program impact' (2006: 15). Thus, multidisciplinary and mixed-method approaches, based on the pragmatic goals of both development and assessment of programme intervention, can sustain a more detailed and holistic approach to software development and evaluation. In the second case, a

collaborative bottom-up approach to development and evaluation locates the project directly in the field of educational practice.

This document focuses on the methods and methodologies to be used to implement and evaluate Prototype 1, and on their ethical implications. The evaluation of Prototype 1, taking place between August 2009 and February/March 2010, seeks to gain knowledge on how the phone and its related technology can be improved. It pursues this overall goal by applying a mixed-method approach and collecting both quantitative and qualitative data in order to evaluate:

1. the effect of the introduction of an ICT tool based on persuasive technology in developing the children's social skills, self management skills and social integration;
2. the applicability of the ICT tool to the learning environment – i.e. how it fits in with existing practices of teaching and learning AND what impact it has on such practices;
3. gaining feedback on the development, improvement and overall technical assessment of the ICT tool and elucidating recommendations for functional changes for Prototype 2.

*Cognitive psychology*, as detailed in the specific section below, is responsible for designing sound scientific tests and measuring the effect and efficiency of the Personal Mobile ICT tools in relation to (1) above. The effect and efficiency of the HANDS toolset will be measured as the progress relative to an individual baseline established before the tests.

*Persuasive technology*, as detailed in the specific section below, is responsible for creating a design experiment, where the core ideas of Persuasive Technology – that is credibility and intrinsic motivation, and their potential for use with children with autism, are evaluated. This relates to (1) and (3) above.

*Applicability to the Learning Environment*, as detailed in the specific section below, is responsible for research considering how the use of the HANDS toolset may be integrated into the learning environment, in relation to (1) above. It also includes a qualitative evaluation of the effect of the ICT tool in developing social skills as in (2) above. The evaluation and results from all three aspects will also crucially provide recommendations for changes and developments required for Prototype 2, as in (3) above.

More schematically, the three research sections can be considered as follows:

Academic institution	Acronym	Research aims	Research questions
ELTE University, Budapest	CP	<ol style="list-style-type: none"> <li>1. to elaborate detailed research methodology and to coordinate test preparations (such as recruitment criteria and baseline measurements);</li> <li>2. to specify design and content principles on the basis of experimental evidence and cognitive psychological expertise;</li> <li>3. to run exploratory tests on first prototype of HANDS software, to reveal strengths and weaknesses, so to make suggestions for further product development;</li> <li>4. to coordinate extensive longitudinal tests on the effectiveness of the final prototype software (in terms of expected change in social and self-management skills);</li> <li>5. to elaborate a Future Research Plan on mobile ICT for socially marginalised young people [for Prototype 2]</li> </ol>	<ol style="list-style-type: none"> <li>a) Is there any comprehensive effect of the HANDS approach, which would be recognisable on the level of symptoms or adaptive behaviours?</li> <li>b) Is there any effect of the HANDS approach specifically on the level of skills focused in our intervention (especially social skills)?</li> <li>c) Is there any specific and individualised effect on the level of specific examples of social or daily living behaviours?</li> </ol>

Academic institution	Acronym	Research aims	Research questions
<b>Aalborg University</b>	PT	<ol style="list-style-type: none"> <li>1. To carry out a design experiment using Persuasive Technology as foundation</li> <li>2. To theorise the area of evaluating Persuasive Design</li> <li>3. To elaborate a future research agenda for ICT technology supporting social marginalized young people</li> </ol>	<ol style="list-style-type: none"> <li>1. To what extent – if any – are principles of Persuasive Technology useful in aiding the teachers in their work with cognitive support systems?</li> <li>1. To what extent – if any – are principles of Persuasive Technology useful for young people with an autism-diagnosis in attaining learning goals and social goals?</li> <li>3. In preparing for a) and b) emphasis must be given to another fundamental question: How can we measure persuasive potential and effect in the use of Persuasive Technology?</li> </ol>
<b>London South Bank University</b>	ALE	<ol style="list-style-type: none"> <li>1. Specify the needs of teachers and young people in the classroom context, providing input to development of the functional specification of the HANDS toolset</li> <li>2. Evaluate the applicability of the HANDS toolset in the school environment</li> </ol>	<ol style="list-style-type: none"> <li>1. What effect does the ICT tool have on the children’s social skills?</li> <li>2. How does the HANDS toolset impact on the teachers?</li> <li>3. How does the HANDS toolset impact on the wider</li> </ol>

		3. To elaborate a Future Research Agenda for ICT tools for socially marginalised young people [For Prototype 2]	field of school and home?
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**Table 1: outline of research aims and questions for each of the three research proposals**

### *Log Files*

The overall architecture of the HANDS software allows for advanced feedback to be recorded within the system. This means that all interaction with the system is logged, stored on our secure servers, and can be accessed by the relevant researchers in accordance with ethical protocols. Thus this is a full record log system that records every action within the software, as specified in Deliverable D5.1.1, down to field level. Thus the log data for pupil contains at least: pupil id, time, which part of the toolset was used (e.g. HiPD, SSSI), input actions by users at field level, and also GPS positioning data depending on phone functionality. All data stored is password protected, and when transmission to and from the central server, including IP transmission, a secure data encryption algorithm is applied. In order to access the data, login as teacher or researcher is necessary. This reflects the two-fold use of the log files:

The teachers may request a report from the log files that documents how a given pupil have been using the parts of the phone, specifically, the teacher will be able to monitor actual use of the calendar or other cognitive support systems. This creates a new for the teacher to evaluate strategies in relation to a child. It should be noted that the teacher in this case is responsible for the interpretation of data. For instance, the most helpful SSSIs are not necessarily the ones that are used the most.

The researchers will also benefit from the log files. For example, in the PT test design and the ALE test design, the log files are important instruments in shaping interview guides, as they inform the researchers of actual usage. It is possible to request data from various parts of the population, e.g. all pupils at a given school. In evaluating the persuasive effect (from a Persuasive Technology point of view), the researchers are responsible for transforming the data into detailed research questions. This design enables the researcher to spot patterns of use that would normally not be detectable, e.g., because the use takes place at different times during the day. It also helps to qualify the interviews, because the researcher will already know to what extend the phone is used before the interview takes place. This way, questions and conversations can center on qualitative matters.

One of the integral functions of the ICT tool is the CoMe (Credibility 'O Meter). The CoMe functions simultaneously as an area where data can be stored about individual children such as learning objectives, individual targets etc.. but also crucially acts as a data log for phone actions. Thus the CoMe will log when the phone is switched on, when a particular function is initiated, for how long etc.. For certain phone functions – for example, in the SSSI, for a particular intervention there can be an alarm reminding the child to undertake a task. The CoMe will log how many times the alarm sounded before the child responded. The CoMe data logs will be a very important source of data across the project, including the ALE research plan. The information on how frequently and at what times the phone was used, and what functions were used will be particularly useful in gaining an initial understanding of the pattern of use of the phone. Further, the use of this function will represent the first attempt to introduce *a new data source* into cognitive psychological research, both basic and applied: *electronic footprints* as a historically new source of empirical data for research in the cognitive psychology of autism. This empirical data-source is expectedly non-biased, may come from various real-life situations, is objectively recorded, and its time-range may spread over years. The CoMe will, as well, provide crucial information for the Persuasive Technology and Applicability in the Learning Environment evaluations.

### CoMe Data Set

The CoMe Data Set has been specified in Deliverable D5.1.1

### *Other Project Level Evaluations*

#### Child Specific Dataset

In all settings, specific information will also be gathered on the children using the ICT tool – termed the child specific dataset. Such information to be coordinated across the three strands of research. This will include demographic information, information on diagnosis and teaching strategies, as well as including a description by their teachers and parents of the child. Further, relevant documents such as individual education plans or equivalent will also be included in the child specific dataset.

#### School Specific Dataset



Further, in all settings, specific information on the structure, organization and working practices of the school will also be sourced. This will include basic structural information such as number of pupils and teachers, as well as teaching approaches, and management approaches. Such information will be termed the school specific data set. Schools will be invited to give further written information on whole school factors.

- **3. Testing and methods**

Each one of the three research proposals seeks to collect data using the following approaches and methods. These approaches and methods are considered in more detail in their specific sections below.

Research proposal	Approach	Methodology	Methods
CP	Efficiency testing	quasi Randomized Clinical Trial (quasi-RCT)	<ul style="list-style-type: none"> <li>• The Autism Diagnostic Observation Schedule (ADOS)</li> <li>• The Autism Diagnostic Interview Revised (ADI-R)</li> <li>• Wechsler Intelligence Scale for Children, 4th Edition (WISC-IV)</li> <li>• Vineland Adaptive Behaviour Scale (VABS) [Prototype 2]</li> <li>• Social Responsiveness Scale (SRS) - <i>for testing specific skills</i></li> <li>• Experimental Task-Analysis (ETA) - <i>for testing specific behavioural-level effects</i> [to be administered only in AF for Prototype 1]</li> <li>• Eye-tracking [only in AF/ELTE]</li> </ul>
PT	FCA ( <i>Formal Concept Analysis</i> )	Mixed-method	<ul style="list-style-type: none"> <li>• Log files harvested throughout the test period (<i>mainly through the phone use</i>)</li> </ul>

			<p><i>and the CoME- across all 4 test sites))</i></p> <ul style="list-style-type: none"> <li>• Qualitative approaches, in particular observations of use and semi-structured interviews (at Egebakken and Svedenskolan)</li> <li>• Quantitative approaches (explicitly harvested), in particular self-evaluation</li> </ul>
<b>ALE</b>	Ethnographic	In-depth case study	<p>Across all 4 schools sites:</p> <ul style="list-style-type: none"> <li>• Questionnaires to teachers and school support staff</li> <li>• CoMe log files</li> <li>• Guided writing task for children</li> </ul> <p>Helen Allinson primarily and subset at Egebakken</p> <ul style="list-style-type: none"> <li>• Semi-structured interviews (parents, teachers and children)</li> <li>• Unstructured (informal) and semi-structured (formal) observations</li> </ul>

**Table 2: Overall Evaluation Framework**

As evident from the above table, evaluating the effectiveness of Prototype 1 is predicated on a variety of methods for collecting relevant data.

### 3.0 Summary of the Overall Study Design

The design represents a mixed mode approach whereby the summative judgements gained from the CP quantitative testing provide a reliable indication of the effect of the use of the mobile ICT tool. The qualitative testing proposed both for ALE and PT strongly complement this data in that they provide evidence of the actual specific experience of the actors using the tool, and thus give a potentially rich and in-depth source of information about individual case studies. Thus the ALE and PT qualitative data can increase the overall validity of the evaluation and can be seen as “filling in the gaps”. Further, the use of the CoMe log data provides an accurate picture of the how the tool was used and be used to triangulate both the qualitative and quantitative data, as well as providing an indication of potential lines of inquiry in semi-structured interviews for both ALE and PT. Similarly, the eye-tracking testing included as part of the CP Research Proposal as detailed below, also gives valuable information on the optimal design of the tool, which again can be triangulated with data gained from interviews with children and teachers as to the effectiveness of the tool.

The CP quantitative efficiency testing is, though, at the centre of the overall evaluation framework, and as such the overall study design and recruitment criteria are determined primarily by the CP testing requirements.

- **Summary of the CP Quantitative Testing Design:**

#### *Rationale of testing*

The CP Quantitative Testing plans to measure efficiency by psychometric-behavioural methods on three distinct levels:

- *general effects, measured by standard, comprehensive tools*
- *skill- or ability-level effects, measured by more focused tools*

It must be emphasised that the three levels cannot be separated absolutely sharply from each other, but it is nevertheless a useful conceptual guideline to structure research questions and research tools.

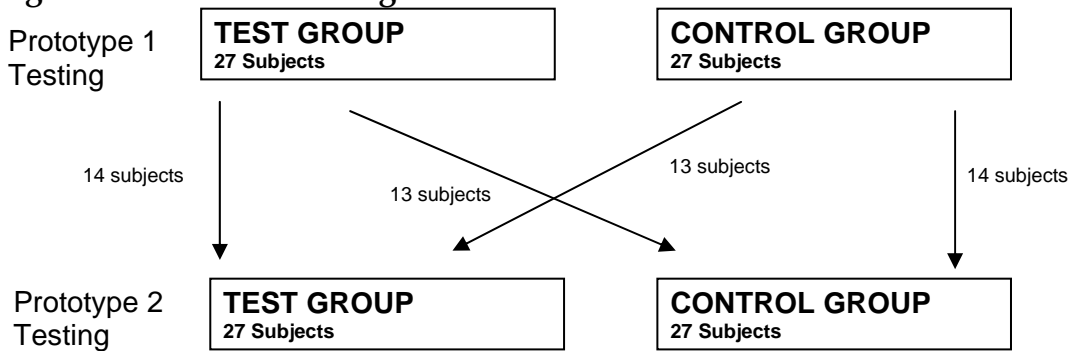
*General effects* – if there is any generalised effect of using the software, in terms of weakening symptoms of autism, and/or behavioural problems, strengthening social, communicative, adaptive skills *beyond* the actual and specific focus of HANDS-based intervention during testing. These effects are to be measured by ADOS (Autism Diagnostic

Observational Schedule; Lord, et al., 2002) and VABS (Vineland Adaptive Behavior Scales, Sparrow, et al., 1984), as standard, comprehensive tools.

*Skill- or ability-level effects* – here we use a standardised instrument, SRS (Social Responsiveness Scale; Constantino & Gruber, 2005) a concise, formalised and focused questionnaire, with a version for parents, and another for teachers.

*Specific effects* – measuring the benefits of the HANDS software in respect to the very specific target problems, the specific focus of HANDS-based intervention in the testing phase. Specific effects are more complicated to measure as the specific foci of HANDS-based intervention will vary across individuals. Here we develop an ‘experimental task-analysis methodology’ (ETA) to register specific individualised effects of HANDS intervention not only in school settings, but in home settings too.

**Figure 1 Overall Test Design across all four schools**



**Table 3 Detailed Timeline for CP Testing Prototype 1 and Prototype 2**

	RECRUITMENT	PROTOTYPE 1 TESTING		PROTOTYPE 2 TESTING	
	0 measurement selecting subjects	1st measurement baseline for PT 1	2nd measurement effects of PT 1	3rd measurement baseline for PT 2	4th measurement effects of PT 2
		~ June 2009	~ Jan-March 2010	~ June-Aug 2010	~ Feb 2011
	<b>ADI-R</b> (anytime in the past)				
	<b>WISC-IV</b> (relatively recently)				
<b>general effects</b>	<b>ADOS</b> (any time in past)			<b>ADOS</b> (date above)	<b>ADOS</b> (date above)
				<b>VABS</b> (date above)	<b>VABS</b> (date above)
<b>skill-level effects</b>		<b>ALL: SRS</b>	<b>ALL: SRS</b>	<b>ALL: SRS</b>	<b>ALL: SRS</b>
<b>specific effects</b>		<b>AF only: PILOT task analysis tests</b>	<b>AF only: PILOT task analysis tests</b>	<b>ALL SITES: task analysis tests</b>	<b>ALL SITES: task analysis tests</b>

Thus the CP testing is based on a randomized controlled crossover design. This design allows for:

- 1) Unbiased comparison of Test to Control Groups for Prototype 1
- 2) Unbiased comparison of Test to Control Groups for Prototype 2
- 3) Isolation of the effects of the involvement of Prototype 1 for Prototype 2 testing

### *Sampling criteria*

The use of efficiency testing and, consequently of the quasi Randomised Clinical Trial (quasi-RCT) to the evaluation of both Prototype 1 and 2 demand strict criteria for sampling and inclusion. Young people taking part in the research, both in the experimental and control group will be selected according to the following criteria:

<b>Criteria</b>	<b>Selection procedure</b>
Diagnosis	Diagnosis of Autism Spectrum Disorder confirmed by ADOS and ADI-R
Age range	Between 10-16 at the start of the research
IQ range	70 or above on the WISC-IV or WISC-III
Language level	Expressive language above 4 years
Form and amount of therapeutic and/or	All young people should regularly attend for at least 6 months prior to the testing an autism

educational intervention	specific school on a daily basis
--------------------------	----------------------------------

### **Diagnosis**

All subjects must have a firm diagnosis of an Autism Spectrum Disorder; the clinical diagnosis must be confirmed by ADOS *and* ADI-R. The date of the ADI-R can be anytime in the past. For the inclusion the date of ADOS also can be anytime in the past, and it must be positive at least for ASD. Later on the project, during Prototype 2 testing, however, we will need to administer ADOS twice: once for a (pre-test) baseline, and once for follow-up purpose. The acceptable specific diagnostic categories are:

By ICD-10: *childhood autism, Asperger's Syndrome, PDD-NOS, atypical autism.*

By DSM-IV: *autistic disorder, Asperger's Disorder, PDD-NOS*

### **Age**

At the beginning of the actual testing all subjects should be between 10 and 16 year all children should be available throughout both prototype testing 1 and 2; AND no child should be older than 18 at the end of prototype 2 testing.

### **IQ range**

Subjects' IQ measure should be 70 or above.

Within that, VQ (verbal quotient) should be 60 or above. There is no upper limit, as more heterogeneous selection of subjects along IQ is advantageous. IQ is to be measured by WISC-IV or WISC-III. WISC-IV or III must have been administered after 7 years of age, as the IQ rate can be regarded relatively stable after this age.

### **Language level**

WISC-IV or WISC-III verbal IQ (VQ) scores will be used to calculate a verbal mental age approximation. This calculated verbal mental age estimate should be above 4 years.

### **Form and amount of therapeutic/educational intervention**

As far as possible, all test and control subjects should receive similar forms and amount of therapeutic/educational intervention. Ideally, all subjects should regularly attend, at least for 6 months before actual testing begins, an autism-specific school/class, on a daily basis, where the intervention is based on complex developmental-behavioural approach, with an evidence-based methodological toolkit (such as TEACCH, Pyramid, ABA, etc.).

### **Gender**

While in theory, a boy to girl ration of 4:1 would be ideal, local contextual variables will limit the possibility of maintaining such ratio across the four test sites. Consequentially, as an overall male to female proportion (including all test-sites) any ratio between 1:1 (a balanced sample, ideal for gender comparison) and 10:1 (the 'natural' ratio among very high functioning individuals with ASD) is acceptable on both theoretical and methodological grounds.

- **quasi Randomised Clinical Trial: Assignment to control or test group**

Carrying out the *efficiency testing* procedures in a scientific manner requires, as an ideal case, following a Randomised Clinical Trial approach (RCT). In our case, some specific practical constraints as well as the specific nature of the intervention method to be tested, do not make it possible to follow this ideal, stringent approach. Most importantly, it is impossible, for ethical and practical reasons, to establish a so-called double-blind design. Therefore, in our 'quasi-RCT' methodology, we intend to follow an RCT design as much as possible, though, at some points, we cannot reach that methodological stringency. Our quasi-RCT approach involves two fundamental requisites. In the first instance, it requires establishing a test and a control group and assigned student randomly to either group. The number of young people taking part in the project across the four schools for both Prototype 1 and 2 evaluations is projected, subject to availability and participation, as follows:

Test school	Prototype 1 Number of subjects Test + control	Prototype 2 Number of subjects Test + control
Helen Allison	10 + 10	10 + 10
Svenskolan	6 + 6	6 + 6
Egebakken	6 + 6	6 + 6
Autism Foundation	5 + 5	5 + 5
<b>TOTAL</b>	27 + 27	27 + 27

The validity of the testing procedures relies in adopting a further randomisation for Prototype 2. Furthermore, the efficiency testing design requires forming random groups of equal constitution, i.e. where recruitment and participation allow, each subject in the treatment group has a pair in the control group, and pairs of students would be formed following these criteria:

Criteria	Requirement
<b>Age</b>	The age difference between the members of the pair should be +/- 1 year
<b>IQ</b>	The difference between the WISC IQ score between the pairs should be +/- 10
<b>Gender</b>	The gender of the pairs should, where possible, be the <b>same</b>
<b>Special education history</b>	The two members of the pair should have roughly the same educational history

Overall, the members of a pair should be as similar to each other as possible according to some relevant aspects (see below), except the condition that one of them uses mobile device (intervention/test subject), while the other does not (control subject). We do this to see whether two very similar (at least in some crucial aspect) pupils develop differently in some skills if one of them uses the HANDS toolkit, while the other does not.

### ***Random Assignment of Subjects to Test or Control Groups***

The intention, subject recruitment and participation, is to use a random assignment of subjects, to make the selection of test versus control subjects 'blind'. That is, after forming the matched pairs, one member of each pair is to be put into the test group, and the other one into the control group, but who-goes-where decision should be random. The random assignment will be done individually at each school, via a computer, or – and this is recognized as being of equivalent value - by putting the two names into a hat and have an independent person pull them out, and doing so with each pair one after the other.

### ***Randomization for Prototype 1***

Both randomization and pair wise matching depend on the successful recruitment and participation of subjects on this basis. It is recognized, however, that test school sites may find it difficult to recruit on this basis. This may be because students and parents have a particular view on the randomization and in particular, those students who have been involved with the specification phase of the project may feel strongly that they should have continuing involvement with the actually developed ICT tool. Further, random allocation to treatment and control groups in previous social skills intervention studies with children with autism has sometimes lead to their being a significant drop out rate amongst subjects in the control group. Thus although randomization and pair wise matching are desirable, the actual implementation of the use and evaluation of the ICT tool on this basis is subject to recruitment and ongoing participation. Thus test school sites participating in the study will be able to opt, for Prototype 1, for a non-random allocation between treatment and control groups. In such cases, pair-wise matching will not be undertaken. It is expected that Helen Allison school will elect for a non-random allocation, where allocation to the treatment group will be primarily based on prior student involvement in the specification phase. However, the children so selected will still conform to the baseline criteria, but not with the randomisation selection procedure.

- **PT and ALE Testing**

The above criteria for recruitment form the core groups with which both PT and ALE will be working with. However, both the PT or ALE research proposals envisage carrying out evaluations only with the children in the treatment groups and not with children in the control groups. Thus the PT and ALE research proposals consist of a case study approach where the cases are selected to fit with the selection criteria for the CP testing programme.



### ***Additional Recruits for PT and ALE Testing***

Subject to recruitment and participation, it is also proposed to potentially recruit a small number of additional recruits for using the ICT tool in Prototype 1. These would be children who fit the general criteria for recruitment as set out above, but are either younger than the age range specified (specifically ages 7-9 at recruitment) or have a lower IQ or VQ, but are still assessed by the professional staff at the school site as potentially being able to benefit from the use of the tool. These subjects would form a separate recruitment sample, would use the tool in Prototype 1 and Prototype 2 phases, and would be subject primarily to the PT and ALE evaluation, as well as being subject to the CP SRS evaluation for Prototype 1 and Prototype 2. This sample would allow for the qualitative testing:

- a) An increased number of students being followed up between Prototype 1 and Prototype 2
- b) A negative case analysis – i.e. would give an indication of the likely efficacy of the use of the ICT tool particularly with younger children and with non-verbal children with autism.

- **Timeline**

The integration of the three research proposals requires all participants, including teachers and educational psychologists, to work to strict deadlines and in a highly collaborative manner. The following table summarises the whole research design for the evaluation of Prototype 1, highlighting the roles and responsibilities of all partners. It is important to point out that the teachers in the four schools will be responsible for the development of ICT tool tasks, and related teaching activities and pedagogical intervention. Specifically, the suite of functions that make up the ICT tool allow the teachers, in conjunction with the children and other actors, to develop specific scenarios on the tool to help children with the development of particular skills for particular situations. It is envisaged that the first month of use of the ICT tool from August/September 2009 will focus on training teachers in the use of the ICT tool and teachers working on developing such scenarios using the tool functions. The research teams at LSBU, AAU and ELTE will support school staff in this process. Researchers at Aalborg have already established a close collaboration with teachers in Egebakken and Svedenskolan, while LSBU will be working closely with HA and ELTE will be working closely with AF. Further deliverable D3.2.1, Implementation and Evaluation Guide will form the basis of detailed implementation advice for schools in the use of the ICT tool.

The specific timelines for each research proposal for Prototype 1 are as follows:

***Persuasive technology testing***

Ongoing collection of data via log files during the period August 2009 to February/March 2010 across the four school sites.

Interviews and observations located at Egebakken and Svedenskolan. August 2009 to February/March 2010.

<b>TIME</b>	<b>METHODS</b>	<b>PARTICIPANTS</b>	<b>LOCATION</b>
<b>September - December 2009</b>	Interviews (on-site) Observations	Teachers, pupils Teacher – pupil interaction	Egebakken and Svedenskolan
<b>December – February 2009</b>	Interviews (phone or similar)	Teachers at all four schools	

***Applicability to the learning environment***

The ALE research proposal aims to collect both in depth data on the school in England, but also more general data on the use and applicability of the mobile solution in the other three schools. For this reason, the ALE proposal includes both interviews and classroom observations to be carried out with teachers, support staff, parents and children at the Helen Allison School, and questionnaires for teachers, and guided writing exercises for children across the other three remaining schools (see appendix for more details on the methods). Time and resources permitting, the ALE proposal also indicates the possibility of conducting some interviews and observations in at least one other school within the consortium.

In more detail, the timeline for ALE will be as follows:

TIME	METHODS	PARTICIPANTS and No	LOCATION
<b>March-July 2009</b> <b>Baseline Setting</b> (school level and children level database)	School documents and artefacts, and informal discussions with teachers and educational psychologist, Initial Observations and Interviews	Variable	Helen Allison (online cooperation with other partner schools and half a day session at Annual General Meeting in Stockholm)
<b>August 2009</b>	<b>PROTOTYPE 1 – EVALUATION</b>		
<b>September 2009</b>	Interviews  Observations	Teachers (7), support staff (4), parents (10) and young people (10)	UK
<b>October 2009</b>	Observations		UK
<b>December – February/March 2009</b>	Questionnaire Interviews  Guided writing	Teachers Teachers, support staff, young people, parents Young people	UK, DK, S, H UK  UK, DK, S, H

### *Cognitive Psychology testing*

The timeline for CP testing is set out in Table 3 above.

## **4.0 Logistic issues related to the preparation of data material and sharing data procedures**

- **Anonymity and secure storage of confidential data**

Test results will be anonymised as follows.

A code system to be implemented across the whole project will replace participants' real names. Such system consists of a letter to identify the role of the participant (T= teacher, C = child, TA = teaching assistant, P= parent) followed by a progressive number (1, 2, 3, ...), followed by the country of origin.

Example:

Tony Brown, teacher	→	T.1.UK
Lars Sorgard, child	→	C.1.DK

Country codes are: UK, DK, HU and SE.

This will ensure anonymity across the sites and a clear referential system. Researchers and teachers in the four schools will be responsible for implementing the system and ensuring that all documents – such as IEPs – or entries in the CoMe database system are fully anonymised.

The general principle is that data within one geographical research grouping can be stored in non-anonymized form. Thus data collected say by LSBU researchers at HA school in the UK can be stored by LSBU in non-anonymized form. However, when such data is transferred across a country boundary, or made available to partners on a secure intranet service, then the data MUST have been anonymized.

Confidentiality will then be further ensured with regard to the storage of data collected throughout the research in accordance to the methods reported in the previous section. Thus, observation notes, interview notes and interview audio recordings will be held securely at academic partner premises. Transcriptions of recordings and reports based on interview notes will be stored securely at academic partner premises. All paper-based materials will be stored in a locked filing cabinet. All electronic data will be stored in a password protected university server shared drive location to which only named individuals involved in the project will have access. All references to individual children and parents will be replaced with an anonymous identification code prior to sharing across country boundaries.

***Responsibility for ensuring that data are collected according to guidelines***

All three research partners are responsible for outlining clearly the nature and process of data collection for their respective research proposals. LSBU is responsible for coordinating guidance on this for all research partners including teachers. This will detail how and when data would be collected. Upon consensual agreement, each school should elect a **lead teacher** responsible for the implementation of the research within their school and responsible for liaising with researchers. Further, each academic institution should elect a **lead researcher**, who will be responsible for overseeing the administration and management of the tests proposed by that institution.

### *Transmission and storing of personal data*

While log file data will be automatically stored in the HANDS password secure website, audio taped interviews, observations logs, efficiency testing measurement, and questionnaire responses will have to be sent to researchers for data analysis and interpretation. While the questionnaire may be developed as an online secure questionnaire, all other data will have to be sent through courier to the relevant university institution. It is recommended that each school makes copies of the documents prior to sending and that these are kept in a secure location within the school premises. The teacher responsible for coordinating the research will also be responsible for the secure storage of sensitive and personal data. Further, when data is either collected by university research staff (e.g. when researcher carry out interviews) OR when data initially stored on school site (e.g. CP tests) is transferred to University partners, the research team leader at each university site is responsible for ensuring the secure storage of such data. The sequence of transmission is that the lead teacher at the test school site initially returns data collected to the lead researcher at the institution that proposed the test. The lead institution is then responsible, after initial collation, for sending the data in collated form to LSBU.

### *Translation of relevant research documents*

Although English is the language used in the project, we cannot expect teachers, parents and children to be proficient speakers. Thus, interviews, questionnaires and guided writing exercises for the students are going to be in the national language of each school. Researcher partners in each higher education institution **responsible for proposing a specific test** are therefore responsible, in coordination with consortium partners, for ensuring that all documents are translated at the highest of standards and within the time frame of the project. These partners are also responsible for facilitating the arrangement of secretarial services for transcription.

### *Efficiency testing measurement and administration of tests*

Educational psychologists in each of the four schools are responsible for the administration of the efficiency testing measures. It remains their responsibility, in coordination with the lead teacher, to ensure that the person to administer the testing is qualified to do so.

### *Central Collation of Data*

All data for the project, which has been reported to initiating project academic partners (ELTE, AAU, and LSBU) will, after initial storage and analysis, be sent to LSBU for collation and initial reporting. The procedures for transmitting and storing data as indicated above will apply here as well. Depending on the specific data requirements, data sent to LSBU for collation may be in aggregated form (for example, for CP tests, the actual raw scores rather than the instrument test sheets).

- **Follow-up design for the evaluation of Prototype 2**

We envisage the evaluation of Prototype 1 to be mainly formative. It will, therefore, focus to a significant extent on improving the use of the phone and related software. It will nonetheless also have two related goals. The first is that of acquiring specific data on each specific research proposal questions; while the other is that of piloting methods and analytical frameworks to be used in the final evaluation of Prototype 2.

With regard to how the design of the evaluation of Prototype 2 will be developed, the three strands of research will evolve differently. The efficiency testing research will use the same instrument and follow the same pre and post-test quasi-RCT procedure, subject to any natural revisions that come to light from experiences during Prototype 2. The focus, questions and methods to be used by PT and ALE will evolve as a consequence of and in relation to findings from the evaluation of Prototype 1.

## **5.0 Ethical Issues**

This section highlights the ethical issues concerned with the research design as a whole and with the use of specific methods. In detailing the approach taken here we refer to the BERA Ethical Guidelines. In particular, we are mindful of the importance of honesty and openness in seeking consent from the participants, and offering up to date and meaningful information at the beginning and throughout the research development. In doing this we are mindful of participants' diverse needs and interests. It should be noted that specific Ethics Approval Proposals, based on the research plan outlined in this deliverable, will be presented to the project EB and local Ethics Committees before any testing or evaluation takes place.

We consider here the following key ethical points:

- **Consent and right to withdraw**

An information leaflet (attached) will be given out to parents in the initial stage. For parents of children participating in observations/interviews, specific detailed information leaflets will be given out and a consent form completed. For children, an information leaflet at their own level will be given out and their teachers will initially request verbal consent to participate, followed by written consent by the children (all forms attached). Participants will receive a copy of the information sheet as follows:

- a) Parents at all schools will receive an information sheet and consent letter at the end of the current school year to be signed and returned to the school at the beginning of the 2009-10 school year. Teachers or their representative are responsible for

collecting parental and children's consent and informing the research partners. Signed consent forms need to be stored securely on school site by the lead teacher and should be verified by the lead researcher.

- b) Children would further receive an information sheet and have a discussion with their teacher about the proposed research a couple of days before first interview. Once again teachers are responsible for collecting the consent form prior to the interview. Signed consent forms need to be stored securely on school site by the lead teacher and should be verified by the lead researcher.
- c) No consent is required from teachers, educational psychologists, assistants or other adult involved in the research as we assumed that as partners they have already agreed to participate. The researchers would nonetheless ensure that the time and place of the interview or classroom observation does not cause harm or distress to the children, does not create excessive workload and does not interfere with the education of all children. <sup>1</sup>

Discussions with project partners, specifically staff at Helen Allison School, have led to agreement within the overall project team that there is no requirement to gain parental consent for general observations, but in these cases specific consent for observation should be obtained in writing by the Headteacher. Parents will be informed of the fact that observations are taking place in the parent information leaflet and a specific information event will be held to explain the research to parents. Negotiations with the schools have indicated that although it is not necessary or appropriate to request specific consent for the observation stage, parents will be at liberty to withdraw their children from this stage of the research on request.

- **General feedback, information procedures and respondent validation**

Undertaking an extensive cross-disciplinary evaluation, as is envisaged for Prototype 1, involves giving specific thought to how teachers, children and parents will be informed about the ongoing process of the evaluation. Whilst keeping to an overarching intention of working with all parties in a collaborative, participative and open manner, certain issues need to be specifically considered.

### *Children*

Children will receive, as a matter of general principle, ongoing feedback about the development of the research. At the implementation stage, when the ICT tool is being introduced, information will be provided as set out in (2) above. In addition, specific information will be given to children on the data items to be recorded in the CoMe and children will have the right to ask to see reports on this data.

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<sup>1</sup> Specific guidance on this point will be requested from the EB, following consortium discussions

With regards to ALE and PT interviews, children will have the right to request to see a transcript of the interview when it has been produced.

With regards to ALE and OT observations, field observation notes may include information that the researcher may wish to withhold from the child, if it is felt that this may have an adverse effect on the child. For example, if the observer observes and makes notes on a child acting out or getting angry. Further, taking detailed field notes in classrooms settings may both be distracting or lead to a sense of examination for some children, and may lead to potential conflict if the observer records such sensitive information. Accordingly, observation notes taken in the field in classroom settings will be in summary form rather than detail, and more detailed notes will be made outside of the classroom. Children will not normally be offered the opportunity to see these detailed field notes, but will be given an edited oral summary by the researcher on request.

### *Teachers and Parents*

Transcripts and notes arising from interviews with teachers and parents will be made available to them for review and comment on as appropriate. Further, results from cognitive psychology tests, eye tracking analysis, will also be made available as appropriate. Further, they will be invited to comment on interview and observation data when appropriate – to give respondent validation – and to ensure that their views and opinions are given space and recognition, and are included in the ongoing process of the evaluation.

It is envisaged, however, that research staff, teachers and parents will as a general principle aim to work collaboratively with children, to give space to hearing and valuing their voice and opinions, and to make sure that these are given a central place in the progress of the evaluation. Thus, within the restrictions outlined above, researchers will take care to provide ongoing feedback to children at a level appropriate to their understanding, and to check with them (respondent validation) that they have gained an accurate picture of their views.

As a matter of honesty and transparency, school staff, parents and children will receive ongoing feedback on the development of the research. This would be done through parents evening meetings or any other form of teacher-parent communication already in place at the various schools. The broad collaborative approach also indicates that data analysis and interpretation should typically be available for teachers for validation or to avoid misrepresentation.

- **Minimising psychological and/emotional distress**

Particularly in the case of children with autism it is important to ascertain their emotional and psychological wellbeing at all stages of the research. While at the broad intentional



level, the research is designed at bringing future wellbeing, daily practical evaluation of the children's state of mind, willingness to participate in the research should be sought. This requires to involve teachers and parents, but also children were possible, to ascertain the appropriateness and propriety of the tools and process of collecting data. Due to the number of factors that can impact on the children's wellbeing, a responsive and situational approach is deemed the most suitable. This requires flexibility on the part of the researchers to adapt the methods, to modify the time and place of interviews, and in some cases to accept that teachers would be the best people to interview the children. Thus, teachers, parents and researchers are together responsible for ensuring that throughout the research the wellbeing of the children is of outmost importance.

- **Avoiding unnecessary workload**

Likewise, it is important to ensure the wellbeing of the adult participants in the research. With regard to parents, this means to keep them informed about research development but also to be open to discussions whenever parents feel the need to seek further information.

With regard to teachers and other school staff, there is a need to minimise workload. This is not only with regard to the possible distress excessive workload can have on the person, but also on the related impact this can have on the children and their education. We are aware that the participation of teachers in the research involves them to be available for interviews and the completion of a questionnaire. These, however, are not the main sources of workload. The project depends on the teachers to plan, monitor and assess the effectiveness of the mobile ICT solution. This in turn and depending on a number of factors, such as technological competence, time available, and professional responsibility toward every child, can contribute to teachers' distress, frustration or even a sense of de-professionalisation.

To counter, prevent or deal with the possibility of any of the above occurring, two interrelated ethical responses are put forward. In the first instance, appropriate training would be made available to all teachers. Further technical support will be made available throughout the evaluation period. Further, the lead teacher in conjunction with the management team in each school will keep monitoring workload issues and seek solutions adequate to each individual situation. The ultimate responsibility for workload management and ensuring that project resources are used to give teachers time to participate in the project lies with the management team at each school.

- **Minimising negative consequences of technology use**

There are a number of possible negative consequences related to the use of technology. They range from the possibility of the expensive technology to be stolen, lost or damaged,

to over-reliance and over-attachment to the phone. They could also entail jealousy from other students in the school and, in case the use of the phone does not yield positive results, a sense of failure and frustration on the part of teachers, children and parents. Finally, there could be the case of students using the phone for purposes not strictly related to the research, either by incurring into overcharges, or, more worryingly, by accessing unsuitable sites on the Internet.

It seems sensible for schools to consider their response to these issues on a local level. As such, no prescriptive actions are presented here. Schools will, however, be advised to consider these issues and possible actions:

1. The purchase of an insurance policy for loss, damage or theft
2. School level guidance on monitoring and dealing with: possible jealousy among students, over-reliance on the phone etc...and, most importantly, an outline document for parents and children outlining clearly how the phone should be used, which fits with the local practices and policies of the school.

Further, the lead teacher at the school should ensure that teachers have considered in advance how they will approach dealing with these issues in their individual classrooms. However, the overall position is that only individual teachers have a true grasp of the interpersonal dynamics in their classrooms and as such they are in the best position to use their professional expertise to decide how best to approach issues such as jealousy from other children.

## **6.0 Further Specific Details on Cognitive Psychology Research/Testing Proposal**

Many of the specific aspects of the proposed CP tests for Prototype 1 are set out above. Further specific details are presented here.

- **Specific Details on Proposed Cognitive Psychology Tests**

### *The ADOS Test*

The Autism Diagnostic Observation Schedule – ADOS Applied in recruitment and in Prototype 2 testing. The ADOS (Lord et al., 2002) is a semi-structured, standardized assessment used all over the world to evaluate the social-communication skills of children, adolescents and adults who are suspected having autism spectrum disorder. It consists of 4 different Modules, with various interesting activities and tasks, depending on the age and level of expressive language of the assessed individual. Considering the age range and intellectual abilities of individuals in our project the subjects will be evaluated with

Module 3. In Module 3 there are some activities (like make-believe play, telling a story from a book, description of a picture, etc.) and some interview questions (e.g. about friends, emotions, social difficulties, etc.) After administering the activities the professional evaluates the observations according to a strict and standard coding system, which – at the end – gives an accurate quantitative result that can be compared to the standard cut-off.

The ADOS can be administered by professionals (e.g. special teachers, psychologists) who have considerable experience in diagnosis of ASD and got special training in administering and coding ADOS. It takes about 35-50 minutes of administering and approximately the same time to code. In case of Module 3 it is about 50 + 40 minutes.

The request for ethical approval to use the ADOS test presented here is restricted to its use in the recruitment phase, where it is essential in a) ensuring that subjects fit the criteria for recruitment to the study and b) to ensure effective matching of pairs between test and control groups, as outlined below. A further ethics approval request for its use in Prototype 2 general effects testing will be made at a future point.

#### ***The ADI-R Test***

The Autism Diagnostic Interview Revised – ADI-R Applied in recruitment only. The ADI-R (Le Couteur et al., 2003) is a comprehensive, semi-structured diagnostic interview where an experienced clinician asks the primary caregiver of the individual suspected having ASD on various behaviours related to ASD. After recording the answers – similarly to the ADOS - the professional evaluates the data according to a strict and standard coding system, and – again similarly to the ADOS – gets a result which can be compared to the cut-off.

The ADI-R can be administered by professionals (e.g. psychologists, psychiatrists) who have considerable experience in clinical interviewing, diagnosis of ASD and got special training in administering and coding ADI-R. It takes about 2-3 hours.

The request for ethical approval to use the ADI-R test presented relates to its sole use in the recruitment phase, where it is essential in providing additional evidence in respect of a) ensuring that subjects fit the criteria for recruitment to the study and b) to ensure effective matching of pairs between test and control groups, as outlined below.

#### ***The WISC-IV (or WISC-III) Test***

Wechsler Intelligence Scale for Children, 4 Edition – WISC-IV applied in recruitment only. WISC-IV (Wechsler, 2003) falls under the family of Wechsler intelligence scales designed to measure the intellectual ability of children 6,0-16,11 years of age. It has 10 core subtests and 5 supplementary ones. In the HANDS research we definitely would like to use the core subtests. The WISC-IV gives a Full Scale IQ and four other Indexes (Verbal

Comprehension Index, Perceptual Reasoning Index, Working Memory Index, Processing Speed Index) It can be administered by psychologists experienced in using WISC-IV. It takes about 65-80 minutes to administer.

Some schools may be using the WISC III test, as the WISC-IV test may not be available in the home language of certain countries (e.g. Denmark). WISC III has roughly the same logic and characteristics as WISC IV, apart from the fact that that the former has also 10 obligatory but only three optional subtests, and it gives additional indices to WISC-IV. The WISC III test is also fully acceptable for recruitment criteria and matching purposes.

The WISC-IV or WISC-III test are routinely used by all the test schools in the project as part of their existing practice and schools have relatively recent WISC-IV or WISC-III data on all subjects who could potentially be involved in the study. , Thus schools are typically using these as part of their typical evaluation activities with children, and as such specific consent for these tests, where they form part of existing working practice, is not requested. If there is a situation where a subject would not have had the WISC-IV or WISC-III test administered as part of the school's typical working practices, then consent will be requested to include the test as part of the HANDS Cognitive Psychology Recruitment Testing for that subject.

### ***Social Responsiveness Scale – SRS***

Applied before and after introduction and use of the ICT tool. This is a 65-item questionnaire that specifically captures the type of social impairment that is characteristic of autism spectrum conditions in children from 4 to 18 years of age. It is a quantitative scale which can measure the severity of a wide range of the most common symptoms of ASD. It has two versions: for parents and teachers. In the practice it means that the parents and teachers have to evaluate the given child's behaviours/characteristics on 4-points Likert scales (i.e. from 1 to 4) regarding to the 65 items. It can be used as a screener in clinical or educational settings, an aid to clinical diagnosis, or *a measure of response to intervention*. In the HANDS project we will use this last function, as beside the Total Score, the SRS gives scores for five Treatment Subscales: Receptive, Cognitive, Expressive, and Motivational aspects of social behaviour, as well as Autistic Preoccupations, which were specifically designed to evaluate treatment programs.

It takes just 15 to 20 minutes to complete for the parents and teachers, and due to its AutoScore form, the scores can be calculated easily and quickly by the clinicians.

- **Further Details on Eye-tracking Tests**

### ***Background and rationale***

We intend to use *eye-tracking* methodology to test if the design of the user surface is efficient enough to convey the necessary information in the most adaptive way for its users, namely, teenagers with autism spectrum disorders. That is, this methodology is meant to serve the aim to develop the most efficient softwares within the HANDS project, and to control this efficiency in systematic testing, as rigorous as possible.

The goal of eye movement measurement and analysis, in general, is to gain insight into the viewer's attentive strategies. These strategies – that is, the actual pathways along which our eyes scan a scene – are strongly influenced by not only strictly perceptual processes, but also non-perceptual higher cognitive functions (see, e.g., Boraston & Blakemore, 2007; Duchowski, 2007). This fact makes the application of eye-tracking technique highly necessary in a project designing softwares for effectively helping the social adaptation of individuals with autism. Eye-tracking technique is able to open a window on how effectively designed a user surface is, in terms of minimising (1) the attentional effort needed to pick-up relevant information, and (2) the non-adaptive, diverting elements of the user surface – so maximising efficiency. This is even more important in case of a target group living with autism spectrum disorders, because – as it is more extensively described in Project Deliverable 2.2.1, *Report on initial cognitive psychology requirements on software design & content* – these conditions are characterised by specific cognitive impairments and by atypical cognitive organisation.

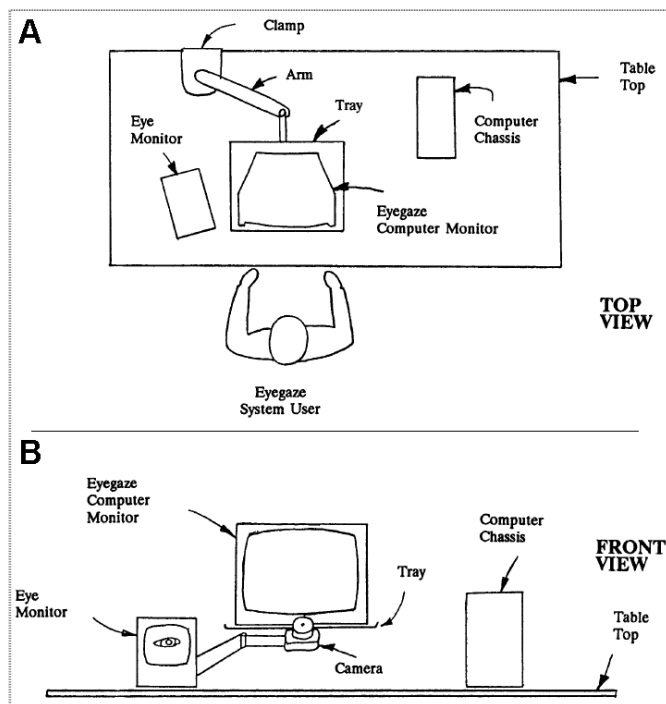
The major specific motivation for its use in the HANDS project is that the standard toolkit of Persuasive Technology is developed for neurotypical individuals, while in autism a complex pattern of atypical cognitive functioning is present. Therefore, elements of Persuasive Technology do not necessarily have the same effects in this population as they intended to have, and as they indeed have in neurotypical individuals.

The influence from impaired/atypical cognition will expectedly be even stronger under stress conditions – as autistic features generally manifest themselves more strongly under stress. Regarding that HANDS software is intended to be used partly under stressful conditions of problematic social participation, it is even more important to control the quality and extent of atypical, partly maladaptive attentional-scanning patterns.

### ***Setting and equipment***

In the HANDS project we use an eye-tracking instrument called Eyegaze System, created by LC Technologies, Inc. Eyegaze System is designed to measure a person's gaze-point on a computer screen. As it is illustrated in **Figure 2** below, this is a desktop-mounted system: nothing is attached to the user's head during eye-movement recording, and gaze-point measurements are made unobtrusively via 2 remote video (infrared) cameras mounted below the camera monitor. Cameras are integrated with infrared light sources that send in sum 120 invisible and non-irritative infrared signals to the subject's eyes per second. Eye-

gaze data are calculated 120 times per second, and are sent to, recorded, and partly analysed by a specifically modified computer system, which also controls the presentation of stimulus displays of the screen.



**Figure 2:** During eye-scanning the subject sits comfortably in front of a computer monitor at an optimal viewing distance of sixty cm from the screen. Copyright: Interactive Minds, Dresden.

Eye-tracking measurements within the framework of the HANDS project are to be done in the newly-established Atypical Cognition and Communication Lab of the Department of Cognitive Psychology, ELTE University. This Lab has been equipped – as briefly mentioned in section 1.6 of this document – with an ‘Eyegaze Analysis System’ binocular, 120 Hz, desktop-mounted, infrared eye-tracker system, controlled by a specifically modified personal computer, and equipped with a NYAN 2.0 software for stimulus control and data analysis. The equipment (hardware) is a product of the LC Technologies, while the analysis software was supplied by Interactive Minds (Dresden). See Figure 3.



**Figure 3:** The Eyegaze Analysis System eye-tracker in the Lab. Left side: subject's desk with monitor and infra-red LEDs and cameras. Right side: the experimenter's desk with the control PC, eye control monitors and control keyboard.

### *Design and procedure*

One of our primary aims is to simulate to some extent the process as a subject (1) gets acquainted with the smartphone/palmtop itself in a relaxed context; then, (2) the subject gets acquainted with the HANDS software in a relaxed context; and, finally, (3) the subject uses the software in situations that involve stress (to a varying extent). These three steps towards simulated in-situation use of the HANDS software correspond to three task conditions applied throughout the eye-tracking testing:

Condition 1: *familiarisation*.

Condition 2: *relaxed usage*.

Condition 3: *pressurised usage*.

Table 3 below shows the overall scheme of a testing session. Testing is managed personally by Dr Miklos Gyori, a psychologist with considerable experience in research in autism. Although estimated total testing time is 136 minutes, no pilot measurement (from among 9) took longer than 75 minutes, and this time period involves several short breaks, so the procedure is not especially tiring. The procedure can be, and will be suspended or ended at any time upon the request of the subjects, or their parents/attendants. Parents

(other attendants) can be present at the measurements, or can be waiting in the room next to the Lab, optionally, according to their wish.

rank	activity	content	time control	exact / maximum time (minutes)
1	WARM-UP, ADAPTATION, CONSENT	semi-structured	open	5
2	calibration	fixed, computer-based	open	3
3	instruction: general	fixed, computer-based	open	5
4	instruction: general familiarisation 1	fixed, computer-based	open	1
5	<b>test: general familiarisation 1, 'empty screen'</b>	<b>fixed, computer-based</b>	<b>maximised</b>	<b>3</b>
6	RESTING ACTIVITY	semi-structured	fixed	3
7	calibration	fixed, computer-based	open	3
8	instruction: general familiarisation 2	fixed, computer-based	open	1
9	<b>test: general familiarisation 2, 'social actor'</b>	<b>fixed, computer-based</b>	<b>maximised</b>	<b>3</b>
10	RESTING ACTIVITY	semi-structured	fixed	3
11	calibration	fixed, computer-based	open	3
12	instruction: familiarisation, task theme 1 / display style 1	fixed, computer-based	open	1
13	<b>test: familiarisation, task theme 1 / display style 1</b>	<b>fixed, computer-based</b>	<b>maximised</b>	<b>3</b>
14	filling task 1.1	fixed, computer-based	fixed	1



15	instruction: relaxed task, task theme 1 / display style 1	fixed, computer-based	open	1
16	<b>test: relaxed task, task theme 1 / display style 1</b>	<b>fixed, computer-based</b>	<b>maximised</b>	<b>2</b>
17	filling task 1.2	fixed, computer-based	fixed	1
18	instruction: pressurised task, task theme 1 / display style 1	fixed, computer-based	open	1
19	<b>test: pressurised task, task theme 1 / display style 1</b>	<b>fixed, computer-based</b>	<b>maximised</b>	<b>0,5</b>
20	RESTING ACTIVITY	semi-structured	fixed	3
21-29	cycle 11-19 repeated for task theme 2 / display style 2; <b>(3 tests)</b>	fixed, computer-based	maximised	13,5
30	RESTING ACTIVITY	semi-structured	fixed	3
31-39	cycle 11-19 repeated for task theme 3 / display style 3; <b>(3 tests)</b>	fixed, computer-based	maximised	13,5
40	RESTING ACTIVITY	semi-structured	fixed	3
41-49	cycle 11-19 repeated for task theme 4 / display style 4; <b>(3 tests)</b>	fixed, computer-based	maximised	13,5
50	RESTING ACTIVITY	semi-structured	fixed	3
51-59	cycle 11-19 repeated for task theme 5 / display style 5; <b>(3 tests)</b>	fixed, computer-based	maximised	13,5
60	RESTING ACTIVITY	semi-structured	fixed	3
61-69	cycle 11-19 repeated for task theme 6 / display style 6; <b>(3 tests)</b>	fixed, computer-based	maximised	13,5
70	CLOSING	semi-structured	maximised	10
TOTAL POSSIBLE TESTING TIME (minutes):				136

**Table 3:** A somewhat simplified summary of the total testing procedure. **Bold** typesetting marks the measurements (eye-gaze recordings). Although estimated total testing time is 136 minutes, no pilot measurement (from among 9) took longer than 75 minutes.

### *Subjects*

In line with the accepted proposal, 6-8 high functioning pupils with autism spectrum disorder will take part in both Prototype 1 testing and Prototype 2 testing, recruited from among the clients of Autism Foundation, Budapest. All test persons will be of 10-18 years of age, and shall take part in the eye-tracking testing on voluntary basis, with an informed consent from their parents, and an informed assent from themselves. Ideally, half of these subjects will also be part of the overall HANDS test group at AF, while half of them are to be recruited from the control group.

### *Timing*

Recruitment of eye-tracking subjects will be part of recruitment of HANDS experimental and control groups at Autism Foundation Budapest.

Eye-tracking testing of Prototype 1 will run parallel to the overall evaluation of Prototype 1, and ideally should happen in October and November of 2009.

Eye-tracking testing of Prototype 2 will run parallel to the overall evaluation of Prototype I, and ideally should take place in October and November of 2010.

Data collecting goes automatically during measurements, so no extra time must be allocated to it.

### *Risks and risk management*

The eye-tracking technique to be applied in HANDS evaluation is a non-invasive and non-intrusive technique, based on very weak infra-red signals, so it does not represent any specific risk or danger beyond general risks and dangers that may arise from interactions with personal computers.

In order to minimize these non-specific risks, subjects with known epilepsy will not be included in the eye-tracking sample, to avoid provocation of seizures by the visual stimuli presented on the tracker's screen.

Also, as mentioned above, the testing procedure can be interrupted or ended at any moment during testing, if any undesirable side effect – such as fatigue or stress – arises.

- **Experimental Task-Analysis – ETA**

The ETA is designed to focus on behavioural level effects of the use of the ICT tool. The HANDS ICT tool will be used in very different and individualized ways during the project. Accordingly, the measure of efficiency should also follow this varied implementation. This level of efficiency testing aims to capture the benefit of the HANDS toolkit in case of *every specific child*. However, it is also important to make these measurements uniform or standard, in order to provide the possibility of comparing the results across children.

### *The research design*

To fulfil these – somehow contradictory – criteria above we will use single-case design at this level. In this design we will be able to measure a given skill/behaviour of the specific child before using the HANDS toolkit (baseline), and then the same skill with using the HANDS toolkit in different settings (test).

### *The method*

The method we intend to use is *The Experimental Task-Analysis*, which is a modified version of the TEACCH-based task-analysis technique (for a more detailed explanation see Peeters, 1997). According to this we provide a series of situations/activities in the field of social and self-help skills (the most targeted skills of the HANDS toolkit) with uniform set-up, tools, participants and steps to follow. According to every unique pupil's characteristics her/his teacher would choose the most appropriate two situations (one social and one self-help situation). The important criteria of this choice is that the activity involved in the situation should be unfamiliar and relevant for the pupil, as we would like to test how s/he manages the task – first independently, and secondly with individualized support by HANDS toolkit. As we believe that one of the most important benefits of using HANDS technique is *better transfer* across different settings, this process will be applied both in school and home settings. For the sake of uniformity the situations/activities will be approximately the same across the children and test-sites. Hereinafter we give a description how each protocol for the test situations/activities should be worked up. However – considering the cultural differences across countries – to take minor changes in the protocol is allowed for the test-sites.

### *Steps in applying the ETA:*

#### (1) Baseline

- a) Preparation: the teacher develops a detailed, step-by-step description of the targeted activity by observing another adult doing the given activity. The result of

this will be a kind of „model“ or „ideal“ description which will be the goal state of the intervention.

- b) **Assessment:** the teacher asks the pupil to do the same activity, observes it carefully and makes a detailed and formalised record about it. The teacher is not allowed to give any help to the pupil. A video recording should also be made about this process.

This phase will be administered in home setting as well, also with video recording.

- c) **Evaluation:** the teacher compares the model process delivered by the adult and the activity of the pupil and identifies the differences, both in home and school environment.

## (2) Planning the specific intervention

According to the identified difficulties of the pupil during the baseline activity, the teacher develops an intervention programme, running on the pupil's smartphone with the HANDS toolset.

## (3) Implementation of the specific intervention

The teacher implements the intervention (i.e. teaches the pupil to use the HANDS support).

## (4) Testing of the outcome – in school and home settings

Using the same observation protocol as in the baseline, the teacher records the same activity, now with the help of the smartphone. Video recording here is also needed.

It should be noted that the ETA will be used with the test and control groups at AF only in Prototype 1, acting as a pilot of the instrument. The ETA will then be rolled out for use across all the test schools for Prototype 2.

## **7.0 Further Details on Applicability in the Learning Environment Evaluation**

### **• Applicability in the Learning Environment**

The term ALE is used to reflect the interest in a) how the teachers and children integrate the ICT tool in to their existing practices of learning and teaching, b) the impact of the introduction of the ICT tool on the key project aims of developing children's social skills, self management and social integration and c) what effect the introduction of the ICT tool

has existing practices of learning and teaching. Crucially, we take the position that these three strands are intertwined, and particularly that the effect of the ICT tool in developing the social skills learning of the children cannot be properly considered separately from its positioning in relation to the particular classroom practices of the teachers and children.

- **Theoretical Frames for the Study**

We approach the theoretical framework for ALE evaluation from a number of positions, as follows:

1. We consider the introduction of the ICT tool as an example of a technology innovation in the classroom and as such locate this project within the existing research on educational technology and in particular educational technology for children with autism
2. We locate the introduction of the ICT tool as an example of a social skills intervention for children with autism. This literature has been more comprehensively summarized by ELTE University in Deliverable D2.1.1.
3. We locate the introduction of the ICT tool as an example of a new teaching innovation for children with special educational needs in the special school classroom. As such, we locate the use of the ICT tool on the literature on teacher thinking on special educational needs.
4. We locate our evaluation of the introduction of the ICT tool as an example of a limited ethnographic approach, involving the use of case studies. Further, we consider the use of a specific psychosocial approach to evaluating the teachers' experience of using the ICT tool, delimited as a particular type of ethnographic approach.
5. We locate our approach to working with actors in the field of study as broadly collaborative, where we recognize the expertise and knowledge of teachers, children and parents. We based this, amongst other influences, on Amartya Sen's capability approach. According to Sen, the evaluation of whether any intervention is effective towards development should start from the examination of whether the intervention was successful in achieving what each individual has 'reason to value as the life he or she wants to lead (Sen, 1992, 1999). This is balanced, however, by a recognition that when considering the split between self-identified and externally identified benefits that there can for adults working with autism potentially be conflicts between the two and that indeed much of the professional work of teachers is to achieve a balance between the two. It is necessary, therefore, to consider the different weight that may need to be applied to children's views and adult's views when considering working with children with autism, even where a broad participatory approach is adopted. This tension is also addressed within theoretical frame 3.

### Note 1

The focus of the project is not just on teachers, but also on other adults involved in working with the children in partner schools – including classroom assistants, speech and language therapists, and care workers in linked residential settings (specifically at Helen Allison School). For the sake of brevity, however, the term teachers will be used to encompass teachers and other adults working with the children in the school setting.

### Note 2

The overall ALE proposal includes within it field work, data collection and analysis that will contribute to a PhD thesis by J Mintz. This work, whilst forming an integral part of the project and contributing clearly to the overall project aims, is clearly demarcated below. Specifically, it is demarcated within the theoretical frame 3 outlined above – i.e. we locate the introduction of the ICT tool as an example of a new teaching innovation for children with special educational needs in the special school classroom, and methodologically the use of a psychosocial approach as indicated in frame 4. The PhD study will be referred to as the Teacher Thinking Study throughout the rest of this document.

- **Study Design and Methods**

#### *General Design*

As indicated, the overall objective of the study is to use a naturalistic, case study approach that draws on an interpretivist theoretical framework that can be typified as a limited ethnographic approach.

This approach will be used to illuminate the key questions for this phase of the project, namely:

1. the effect of the introduction of an ICT tool based on persuasive technology in developing the children's social skills, self management skills and social integration
2. the applicability of the ICT tool to the learning environment – i.e. how it fits in with existing practices of teaching and learning AND what impact it has on such practices, including:
  - a. How the class teachers' perceptions of the use of a new technology tool in the classroom are influenced by their existing overarching models of learning, SEN and Autism (Teacher Thinking Study)
  - b. How they deal with uncertainty in relation to incorporating a new technology tool in to their existing working practices, including uncertainty relating to areas of practice including diagnosis, the social and medical models of disability, debates on inclusion and integration, and uncertainties in relation to the understanding of and use of new technologies per se. (Teacher Thinking Study)

- c. gaining feedback on the development, improvement and overall technical assessment of the ICT tool and elucidating recommendations for functional changes for Prototype 2

The key research instruments will be:

At Helen Allison School in the UK and possibly at one other test school:

Semi-structured interviews with the teachers, children and parents involved in the use of the ICT tool. These will be supplemented with classroom and wider setting unstructured observations which will allow for a) identification of particular examples of the use of the tool which further elucidation in interviews and b) triangulation between the observer view of the use of the ICT tool and (i) teacher interpretations of the use of the tool in interviews and (ii) children's interpretations of the use of the tool in interviews. Further, interviews with children and parents will be included in the design, as well as the use of "writing/visual" tasks with the children to help stimulate children's consideration and interpretation of their use of the ICT tool.

At the other test schools:

Use of a multiple stage questionnaire by teachers focusing on their interpretation of the use and impact of the ICT tool during the implementation of Prototype 1

Use of "writing/visual" tasks with the children that will provide illumination of their interpretation of the use and impact of the ICT tool

In all settings, specific information will also be gathered on the children using the ICT tool – termed the child specific dataset. Such information to be coordinated across the three strands of research. This will include demographic information, information on diagnosis and teaching strategies, as well as including a description by their teachers and parents of the child. Further, relevant documents such as individual education plans or equivalent will also be included in the child specific dataset..

Further, in all settings, specific information on the structure, organization and working practices of the school will also be sourced. This will include basic structural information such as number of pupils and teachers, as well as teaching approaches, and management approaches. Such information will be termed the school specific data set. Schools will be invited to give further written information on whole school factors. In the case of Helen Allinson school, this will be triangulated with information on whole school factors gained during observations and interviews.

### *Numbers for Interview*

#### Teachers and Other Adults:

At Helen Allison school, it is envisaged that 5 teachers and 2 care workers will participate in interviews. Further, it is intended that at least one Speech and Language Therapist will also participate in the interviews. Further, at least one teaching assistant, but possibly more depending on availability will be included in the interview schedule.

If interviews are carried out at a second site, it is envisaged that 2 teachers will participate in the interview schedule.

Approximately 10-15 teachers at the other test school sites will complete the questionnaire.

#### Children:

At Helen Allison school, it is envisaged that 10 children will use the phone for Prototype 1, and will participate in the interviews.

Parents: It is envisaged that all the parents of the participating children will be given the opportunity to participate in an interview.

No interviews with children or parents are proposed at the other test school sites.

### *Demarcation of the Teacher Thinking Study*

The Teacher Thinking Study focuses exclusively on the experience of the teachers, whilst the formal observations will clearly involve interaction with the children, not formal interviews or data collection will form with children will form part of the study, nor will data collection with parents. Where appropriate, interviews with teaching assistants may form a part of the study, but residential care workers or other adults working with children in the school settings will not form part of the study. Thus its focus is exclusively on the teachers' professional practice and professional thinking.

The Teacher Thinking Study will comprise of an interview series as set out above with 4 teachers at Helen Allison School, or at Helen Allison School and one other test school site depending on operational availability. It will further comprise a series of 4 formal observations. These interviews and observations will largely coincide (i.e. be identical) with the series of formal observations and interviews set out for the overall ALE research plan above.

In achieving demarcation of the Teacher Thinking Study, the following criteria need to be borne in mind:



- Avoiding unnecessary additional workload for teaching staff
- Maintaining the Teacher Thinking Study simultaneously as a demarcated study AND as an integral part of the overall ALE research plan

In order to ensure that these criteria are met, the following strategies will be employed:

- For interviews, questions specific to the Teacher Thinking Study – i.e. in relation to Frame 3 and Key Questions 2a, 2b, will be demarcated as such. These questions will be undertaken by J Mintz and any data analysis in relation to them undertaken by J Mintz. However, questions relating to the general study may be undertaken either by J Mintz or by other researchers, and may be analyzed by either
- For observations, the default proposal is that the use of a psychosocial approach to observations, as defined as being in alignment with a more general ethnographic approach, will mean that the overall project objectives (Frames 1-4 and Key Questions 1-3) can be covered in one observation. Thus formal observations undertaken by J Mintz can cover the specific Teacher Thinking Study objectives (Frame 3, Key Questions 2a, 2b) as well as the general ALE project objectives. In order to allow other researchers working more widely on the overall project to make appropriate links between observations and other data instruments, there may be occasions on which two observers (J Mintz and another researcher) will observe together.

- **ICT Tool Data Logging**

One of the integral functions of the ICT tool is the CoMe (Credibility 'O Meter). The CoMe functions simultaneously as an area where data can be stored about individual children such as learning objectives, individual targets etc.. but also crucially acts as a data log for phone actions. Thus the CoMe will log when the phone is switched on, when a particular function is initiated, for how long etc.. For certain phone functions – for example, in the SSSI (see LSBU Ethics Committee HANDS Research Proposal - Phase 1 June 2008), for a particular intervention there can be an alarm reminding the child to undertake a task. The CoMe will log how many times the alarm sounded before the child responded. The CoMe data logs will be a very important source of data across the project, including the ALE research plan. The information on how frequently and at what times the phone was used, and what functions were used will be particularly useful in gaining an initial understanding of the pattern of use of the phone. This data will also be useful in framing interview questions to the different actors involved. Thus in general, interview guides will be developed in detail during the project, particularly when CoMe data becomes available. However, the outline of specific themes and likely questions is indicated for the various interview categories below.

- **Interview purposes and general themes**

The interviews together with observations and the study and analysis of other documents and artefacts serve the purpose of exploring and examining the applicability of the HANDS mobile solution in depth and in context. In order to do so, interviews will have to be responsive and purposively focused. Responsive means that they have to be meaningful to the context and how the use of the phone develops within the context. They also need to be responsive to the state of mind, needs and wishes of the interviewees. In terms of purpose the interviews should aim to gather data on the key questions outlined above.

In doing so, the interviews will be structured around three main themes:

1. Technical improvement
2. Benefits/implications for children and teachers, including aspects of teacher thinking
3. Validity of persuasive technology

This structuring will achieve the goal of

- supporting the technical development of the software technology and address the needs of developing a functional specification for Prototype 2
- improving our understanding of how new technology is applicable in daily educational contexts, how it impacts on teaching and learning and how it fits in to existing teacher thinking;
- and serving both to support the research questions of the other partners.

Interviews will be recorded on a digital voice recorder and audio tapes will then be transcribed.

### ***Interview structure***

The interview data should support for an in depth understanding of local phone usage and the possibility of collecting data across the four schools that can be generalisable. Semi-structured interviews are the most appropriate means to achieve both aims. The way in which semi-structured interviews are formulated is such for which questions have to be not only appropriate to answering the research questions, but also appropriate to how each context develops the use of the phone. Interviews should also be proper, that is asking questions that do not harm the respondents personally, or can cause the respondent or respondents to disclose facts that would harm him or her or other people with whom the person lives and works.

It is envisaged therefore that the semi-structured interviews will be divided in three parts, one for each one of the themes. For each theme there would be lead questions which

should be the same for all respondents. Because the collection of valuable data also relies in allowing the respondent the freedom and opportunity to focus on what matters to him or her, it is the responsibility of the interviewer to create the context in which the respondent feels comfortable in doing so. However, there might be situations where the respondent does not go into the necessary details, offers conflicting or unclear responses, or, especially in the case of the children, finds it difficult to communicate. Therefore, besides the leading questions the interview should also have a number of probes that the interviewer can use. It is important to note that pre-defined probes may or may not be used, or may be modified in response to the respondents' answers.

### *Participants in the interviews*

While the children and the teachers are the main users and the children the main beneficiaries of the technology, other adults are also involved in supporting the teachers and the children. Thus, also parents, teaching assistants, care workers (this is especially the case in the UK where some of the children spent the week at the residential unit), and other family members or friends should if all possible be interviewed at least once during this phase of the project.

While the structure of the interview is still valid, the questions will have to be adapted to the respondent's abilities (this is especially the case for interviewing the children), or adapted to the particular role the adults play. This is to say that while the interviews to the teachers might focus more on pedagogical practice, the questions for TAs might focus more on their roles as supporters, and those for the parents will focus more on their parenting roles.

The following sections offers details for each sets of interviews with teachers, children, TAs and other support staff, and parents. For each set of interviews aims, themes, possible probes, timeline and ethical considerations will be listed. These are however not final but only indicative.

- **Interviews with Teachers**

We are interested on the applicability of the HANDS mobile solution into the learning environment. Learning environment primarily refers to the school environment, but also to other outside school environments where learning takes place. With regard to the children in the UK, this requires to include the context of the residential unit. In terms of teaching and learning this means to cross over from formal to informal learning. However, the nature of the residential environment is such for which while care workers are not qualified teachers, the do support teachers' work beside supporting the children and facilitating both the learning of living skills and their inclusion in society.

By applicability we mean a number of factors that influence and impact on teaching and learning. The evaluation of the applicability to the learning environment in terms of how the phone can facilitate the task of teachers is a prerequisite for ensuring the wide spread use of the phone into both special and mainstream schools. However, teaching and learning are complex notions and schools are multi-dimensional organisations. The aim of the ALE research proposal is not that of offering a detailed examination of all factors that might influence the applicability of the technology, but that of focusing on how its use interacts with the teachers' practices and attitudes, and with their thinking as teachers, as well as on their evaluation of the impact of the phone on the social skills development of the children. Therefore, the interviews aim to elicit information on how the teachers use the phone; how the phone helps them teach and support children to achieve children social, communication, self-management and living skills; how using the phone has changed their practice; what they find beneficial about using the phone; and, what they think still requires development and why.

In order to capture the change and development of practice, it is proposed to have four formal interviews, one at the beginning or just prior to the introduction of the ICT tool, two during the use of the phone and one towards the end of this phase of the evaluation of Prototype 1. Informal face to face discussions would also take place as part of the ongoing support and collaboration between teachers and researchers at the Helen Allison School. Time and financial support permitting, we would like to have face to face interviews with teachers in at least one other schools. However, due to travel requirements, this would have a slightly different structure – two interviews over a period of a few days shortly after the ICT tool is introduced and two interviews similarly over a period of a few days towards the end of this phase of the project. There is also the possibility of having interviews via online communications with teachers. In any event, where language commonalities allow, it is expected that interviews will be undertaken in English. There may also be further interviews with teachers if initial analysis of the data indicates that this will be useful, if resources are in place to support this.

Although two sets of interviews with the teachers at Helen Allison and two questionnaires for all four schools are the ideal design, we are aware that the time for the implementation, use of the mobile solution and for analysis and dissemination is limited. Therefore, we need to consider both the time it actually takes to collect the data, and the amount of data that is feasibly possible to analyse. The clear division into themes would therefore allow for faster analysis, especially the one on the evaluation of the phone which is needed by the software developers in order to implement the necessary modifications for Prototype 2.

In trying to elicit how the use of the phone has influenced the teachers' practice we envisage two rounds of interviews:

**Initial Interview** – This first round of interviews aims to elicit teachers’ ideas about how they would and could use the phone. It will focus on teachers’ lesson or activity plans, their expectations about what the use of the technology will do for them and for the children, and what benefits it will bring, and concerns they have. For the Teacher Thinking Study, further questions will focus on their professional identity as teachers, their experience of working with children with SEN and autism, and a focus on the decision making process undertaken in strategy selection in relation to children in the class and specifically children using the phone.

**Subsequent Interviews** – This round of interviews will take place during and towards the end of the evaluation of Prototype 1. It aims to offer the teachers and TAs the opportunity to revisit their previous expectations and concerns, and reflect on what they have learned and achieved. The main questions it aims to answer are:

1. What benefits did the use of the phone bring for the children?
2. Did it the phone fit with what the teachers already did?
3. What has changed as a result of using the technology?
4. For the Teacher Thinking Study, further questions will focus on particular instances drawn from observations of the use of the phone by specific children, how these related to their existing models of learning and models of SEN including the place of uncertainty in strategy selection, how the phone intervention compared to other approaches, and the influence of training and support factors

In eliciting views about the applicability of the phone, it also aims to collect data for phone improvement, and in particular on whether the children improved their social and self-management skills and whether the phone was a persuasive tool.

Both interview 1 and 2 are designed to as to gain knowledge and understanding on three main themes:

- **Technical aspects** of the phone and other aspects of the mobile solution)
- **Social skill and persuasive aspects** such as whether the use of the phone was persuasive and helped improving the children’s social and self-management skills.
- **Pedagogical aspects** and in particular on how the phone fitted in with their existing practices, what effect it had on their practice, and for the Teacher Thinking Study, how it related to their existing models of thinking in relation to SEN and autism, including the place of uncertainty in strategy selection.

The following shows what a possible interview protocol for Interview 1 and 2 respectively might be like.

## **Theme 1 – Technical aspects**

### **Interview 1**

1. You have had some opportunities to use the phone and the mobile solution. How do you expect to use the phone in the next few months?
2. What are your expectations?
3. What do you think the phone would help you to do?
4. What do you think it will help the children to do?
5. Do you foresee some problems?
7. How would you solve them?
6. Do you have any concerns?
8. Which features of the phone would be the most useful?
9. Which functions would you think they are the most problematic?

### **Subsequent Interviews**

1. Has the phone met your expectations?
2. In what way has the phone helped your students?
3. In what ways has it helped you?
4. What would you say was the best features of the phone?
5. What would you suggest could be improved?
6. How do you think the Diary function was successful?
7. What would you change or improve?
8. How do you think the SSSI function was successful?
9. What would you change or improve?
10. How do you think the PT function was successful?
11. What would you change or improve?
12. How do you think the CoMe was successful?
13. What would you change or improve?

## **Theme 2 - Social Skills and persuasive aspects**

### **Interview 1**

1. What social or self-management skills do you think the phone will help the children improve?
2. How motivating do you think the phone would be?

### **Subsequent Interviews**

1. What do you think has the phone enabled the children to achieve?
2. Do you think the phone was successful as learning tool?
3. What effect has the phone had on the children's social skills in specific situations?
4. If you think it needs improving, what do you think should be improved, changed or modified?
5. Has there been any effect/change on the children's social skills in general?

### **Theme 3 – Pedagogical aspects: fitting in to practice and changes to practice**

#### **Interview 1**

1. Do you think the phone will fit into your practice?
2. What changes do you think will be necessary?
3. How confident do you think you are?

For the Teacher Thinking Study:

4. Tell me about your background as a teacher?
5. Are there any children for whom you spent time wondering how to work with them?
6. What has it been like working with Child X who will be using the phone?

#### **Subsequent Interviews**

1. How did the phone fit in your practice?
2. What changes were required?
3. How was the activity planned?
4. Who planned it?
5. How was the task monitored?
6. How was the task assessed?
7. What helped you most?
8. What remains to be done?
9. How confident do you think you are now?

For the Teacher Thinking Study:

10. What is it like working with Child X?,
11. How do you decide how to work with them?
12. Are there times when you are unsure what to do?
13. How has the phone helped you to think about working with them?
14. Is there a particular theoretical approach that you use in thinking about X?
15. How does that fit in with the use of the phone with X?

- **Interviews with Teaching Assistants and Care Workers**

The interviews to support staff will follow the same protocol as for the teachers. However, modifications are required for the pedagogical aspect. While specific question will follow from observations of TAs' and care workers' practice, it is feasible to assume at this stage that the role and responsibilities of support staff are closely related to care and support for the emotional wellbeing of the children. Since the way in which support staff work is very variable and most of the time responsive to the needs of the children, we propose to keep the same overall questions. Their answers will not only shed light on the issues already highlighted, but also on how support staff works in supporting both the children and the teachers. This aspect of the research is particularly timely and relevant to a number of UK policies and planned changes to the professional status of support staff.

Interviews for TAs and Care Workers will be carried out at Helen Allison School only. For Care Workers, subject to availability, interviews will follow the same pattern as for teachers. For TAs, one interview will be carried out at the beginning of the introduction of the phone and one towards the end of this phase of the project.

- **Interviews with Parents**

We propose to carry out two set of interviews, one at the beginning and one towards the end of this phase of the project. However, dependent on project resource limitations and limitations on parent's time, this may be restricted on operational grounds to one interview towards the end of this phase of the project/

With regard to parents, theme 1 and 2 are the most appropriate in as much as we believe that:

- parents are pivotal in ensuring that the children use the phone – persuasive aspect
- parents have in depth knowledge of their children potential and difficulties and therefore they are well positioned to assess whether the phone helped their children.

This is the interview protocol for the parents.

**Interview 1**

1. What do you think the phone will help your children achieve?
2. What are your expectations?
3. What would the phone do for you?
4. What problems do you foresee?
5. How would you solve them?



6. How would you motivate your child, if he needs it?
7. How would the use of the phone fit in with your everyday family life?

## **Interview 2**

### **Technical aspects**

1. Has the phone helped your child?
2. What functions were the most useful?
3. What functions were the most problematic?
4. How could the phone be improved?

### **Persuasive and cognitive aspects**

1. Were your expectations met?
2. Have you noticed improvements in your child social skills?
3. Have you noticed improvements in your child self-management skills?
4. Did you have any problems?
5. How did you solve them?
6. Did your child use the phone without help?
7. Did you receive all the support you needed?
8. What would you suggest still needs to be done to help parents?

- **Interviews with Children**

Seeking the views of the children is pivotal for a number of reasons. First, because the children are the ultimate users and therefore they are in the best position to give valuable ideas on how the phone worked, whether it helped them and what needs to be improved. Moreover, consulting the children is also part of the effort to include them and, related to it, their participation in the interviews is also one way in which their social and communicative skills can be supported.

However, consulting children in general and consulting children with learning disabilities in particular is challenging. The pursuit of collecting valid, reliable and authentic data requires us to keep at least two aspects into consideration. The first relates to what is needed to facilitate both understanding and communication. The second aspect relates to establishing conditions that are neither harmful nor overpowering for the child. In the second case, the power relations that exist between adults and children cannot be totally overcome. It is possible, however, to give children the opportunity to express themselves in such a way that they do not feel threatening or coercive. One way to do so is by using focus groups, where possible, or other means such as whole classroom discussions. The use of possible additional methods to elicit the children's views would be the result of

consultation with teachers and parents, and would be brought back for Ethics approval at a later date. However, for now we specify the outline for the proposed interview.

As such interviewing the children aims to achieve three main aims:

- to gather information useful to improve the phone – **technical aspect**
- to gather knowledge on whether the phone helped the children with their social skills, self management and social integration, including a focus on their own perspective – i.e. did it help the children with what the children aspired to be able to do – **social skills aspect**
- to gather knowledge about how persuasive the phone was – **persuasive aspect**

Due to the variability between children, visual means will be used together with more traditional questions. This will involve the use of cue cards, as well as interactive whiteboards (IWB). IWBs would combine oral, visual and written methods of response and they have the potential of being a successful method we can pilot in the first phase of the evaluation.

We do not envisage two sets of interviews since the children would already be interviewed for a number of the testing procedures requires for the CP efficiency testing. Knowledge similar to the one envisaged for Interview 1 can be collected by teachers during their meeting with the children, or as part of the classroom observations and during visits to the school. It is important, though, to make sure that the children know their responses will be used as data and therefore consent should be obtained.

The more formal interviews will take place toward the end of Phase 1 of the evaluation and at a time that is suitable for the children. If at all possible children will be interviewed by the researcher alone without the presence of teachers or other members of staff. However, if this is deemed problematic interviews can be carried out in the presence of other adults. In all cases the children will receive a transcript, or summary that results from the conversation.

The protocol for the semi-structured interviews will be as follows:

#### **Technical aspect**

1. What did you like most about using the phone?
2. What did you like least?
3. What would you change?
4. What will make the phone work better for you?

**Persuasive aspects**

1. Look at these pictures (*cue cards with pictures of mum, dad, siblings, teachers, TAs, friend, phone and himself*). Who helped you the most in doing ... [activity the child was supposed to fulfil]
2. Look at the pictures again. Who did motivate you most?
3. How did [*insert the name of the person or the phone as required*] do it?

**Social Skills aspects**

1. What did you want to be able to do?
2. Did you succeed?
3. What or who helped you to do what you wanted to do?
4. What do you think you still need to learn in order to become better at the task?
5. How can using the phone help you do that?

- **Observations**

As indicated above, the objectives of the observations are to allow for a) identification of particular examples of the use of the tool which further elucidation in interviews and b) triangulation between the observer view of the use of the ICT tool and (i) teacher interpretations of the use of the tool in interviews and (ii) children's interpretations of the use of the tools in interviews.

It is envisaged that both informal "in practice" and formal observation will be employed, both within the general context of a limited ethnographic approach. This means that the objective is get a witness account of phone, in its use in number of dimensions, that is, the planning, use, monitoring and assessment of the tasks and activities. This is in order to gain knowledge on the dynamics of establishing the phone as part of the provision for the children, and the impact it has on teaching and learning. Because two of the goals of the projects are improving the children social and self-management skills the observations will focus on how the child interact with other children and adults through the phase of planning and using the phone. This means that observations will be carried out in the classroom, in the residential unit, but also in other places where the child might be using the phone (e.g. a supermarket). We would also observe how adults in the school work together to plan, monitor and assess the use and worth of the phone.

As indicated, the observations will act as a starting point, for informal interviews, and in some cases follow an interview. With regard to this, we would like to use the observations to gain a better understanding of what the teachers and children think about using the phone and how it helps them.

### **Unstructured (informal) observations**

During the initial implementation of the phone, the research team at LSBU will be involved in a training function, working with the teachers to ensure that they understand how to use the phone. Thus this context provides the opportunity for unstructured ethnographic participant observation, contextualized as informal. It is expected, however, that an there will be an ongoing developing dialogue between the research team and the teachers over the implementation and evaluation of Prototype 1, which presents ongoing opportunities for such ethnographic observations. Depending on which stage of phone implementation the teacher and children are involved in, the observation aims to capture what happens through an account of how teachers and children act. Detailed daily field notes will not be kept of these informal "in practice" observations, but observers will record ongoing field notes on significant events and observations. The frame of reference for these observations is:

1. How does the phone and related technology fit into existing practice?
2. Is the use of the phone beneficial to both teachers and children?

In addition, in the months prior to the evaluation of Prototype 1 some general observations of classroom practice are carried out so as to formulate and understanding of already existing pedagogical practice. To this effect, a number of observations were already carried out during the initial specifications and phone requirement stage in autumn 2008.

### **Structured observations**

These observations are contextualized as formal, non-participant observations and are focused on witnessing how the children use the phone in completing the task the phone should help them with, how the teachers integrate the phone and in to their practice, and for the teacher thinking study. For the teacher thinking study, observations will provide an opportunity to gauge the quality of interaction between teachers and children, indications of how the teachers select strategies for working with the children and how the use of the phone fits in with their overarching models of thinking in relation to SEN and autism. Observations of children using the phone and interactions with their teachers in relation to that will provide starting points for analysis in the interviews with teachers and children. Due to the possible range of locations where the phone can be used (classroom, home, residential or public spaces), it would be impossible to observe the child and/or his helper in all these situations. Thus, depending on the task and how the use of the phone has been designed to support the child, decisions will be made as to when and where to carry out the observation/s. Generally, though, structured observations will focus on collecting data in the context of instances of the children using the phone.

In situ field notes will be taken during observations, and where consent is gained, audio recordings, using a digital audio recorder, of the observation will be undertaken. The audio tape will serve as a confirmatory source of data on the events that transpired during the observation, and will be used during the data analysis in this way. Partial aspects of the audio recordings of particular interest will be transcribed.

Observations at Alternative Test Site School:

Although there will be significant language barriers, there will still be some utility in undertaking observations in tandem with interview sequences planned at an alternative test site school. Where possible, local staff at the school or local research partners will co-observe and provide an observation commentary to be used by LSBU researchers in writing up field notes. The number of observations to be undertaken would be developed by negotiation with school staff.

### **Use of observations to record, monitor and report on the validity of persuasion**

Besides being used to monitor how the use of the phone fits in and impacts on already existing practices, observations can also help in recording valuable data for ascertaining the persuasive effect of the phone. It is still unclear how it is possible to devise an observations schedule to assist in shedding light on the persuasiveness of the technology. However, one of the aims of the Phase 1 of the evaluation of Prototype 1 can be that of forming a pilot stage in which observation methods can be developed further. The development of this aspect of research should be the result of collaboration between Aalborg and London South Bank University.

- **Guided Writing Exercise**

Besides interviewing the students at the Helen Allison School, it is important for an effective evaluation of Prototype 1 to consult as many students as possible across the other three remaining partner schools. While no doubt teachers in the school will collect data on how the children use the phone and think of it as part of teachers' planning, monitoring and assessing cycle, it is also important to consult the students directly. One way of doing this is that of asking the students to write about the phone. In order to help the students in the task and to create a series of artifacts that can offer both a fast content analysis, required by the software developers to work on Prototype 2, and a more detailed and in depth analysis of how the use of phone contributed to the students' inclusion and wellbeing, we propose a 'guided writing' method.

The method seeks to collect data on:

1. The children's use of the phone
2. The benefits of using the phone
3. How the phone can be improved

The guided writing task will be administered to all children in the test group in Prototype 1 during the spring term 2010 and will allow for the elucidation of the views and ideas of the children on their views on the efficacy and usefulness of the ICT tool.

### ***Data Analysis***

Observation field notes and interview transcripts will be analyzed using a thematic analysis (Boyatzis 1998, Braun and Clarke 2006). Thematic categories will be initially developed from the literature review and previous experience, as in Mintz (2007). These will be further developed from the initial set of categories using an interactive approach during the data analysis (Carley 1990), and new categories added as required. The process of data analysis will be iterative (Miles and Huberman, 1994) and responsive to the context in order to acquire a deep understanding of the cultural, attitudinal, professional and

social factors which influence the effectiveness of the technology. The analysis will consist of both content analysis and systemic analysis. The first would seek to achieve an overall understanding of the use and effects of the technology, while the second will critically seeks to make connections between different dimensions and levels of use and professional practice. Data analysis will be supported by the use of data analysis software such as NUDIST or NVivo.

**- ALE Research Plan Timeline and Resources Calculation**

**Research Plan Timeline for Prototype 1**

Unless otherwise specified, tasks are assumed to apply to HA School.

TIMESCALE	ACTIONS	METHODS	Task Resource Requirements
March-June 2009	Liaison with schools on research plan, arranging resourcing for data collection, initial familiarization with technology	Planned liaison meetings, researchers attending on site at HA School	<ul style="list-style-type: none"> <li>• LSBU Research Staff</li> <li>• Teacher in charge of liaison at HA</li> <li>• Some teacher time at HA School</li> </ul>
June-Sept 2009	Initial informal observations and possibly first formal observation  Initial work on consent and permissions  Initial collation of Child Specific Datasets Initial collation of School Datasets  Initial work on	Informal and Formal Observations	<ul style="list-style-type: none"> <li>• LSBU Research Staff</li> <li>• Some work by test school sites on data set collation</li> <li>• HA management – time for scheduling</li> </ul>

	<p>scheduling teacher and other staff time for interviews</p> <p>Initial work on scheduling parental interviews</p> <p>Translation of Guided Writing and Questionnaire Formats</p>		<ul style="list-style-type: none"> <li>• LSBU in coordination consortium partners</li> </ul>
Autumn term 2009	<ul style="list-style-type: none"> <li>• Teacher training (toolset and research methodology) / Informal Observations initiated</li> <li>• Schools start using the phone</li> <li>• Consent and permissions gained for cross-project overall evaluation framework</li> <li>• Detailed scheduling teacher and other staff time for interviews</li> <li>• Initial Interview Series at HA</li> <li>• Initial Formal Observation Series at HA</li> <li>• Initial Parental Interview</li> <li>• Questionnaire</li> </ul>	<p>Informal and Formal Observations</p> <p>Interviews</p> <p>Questionnaire</p>	<ul style="list-style-type: none"> <li>• LSBU Research Staff</li> <li>• HA management – time for scheduling</li> <li>• Scheduled Time for Teacher, other adult staff</li> <li>• Time for questionnaire completion by teachers at other test site schools</li> </ul>



	<p>completed by other test site schools</p> <ul style="list-style-type: none"> <li>• Possible 1<sup>st</sup> Scheduled Visit to alternative test school site for interviews and formal observations</li> <li>• Scheduling of parental and teacher interviews for spring term</li> </ul>		
<p>End Autumn Term 2009/Spring Term 2010</p>	<ul style="list-style-type: none"> <li>• Initial CoMe data analysis</li> <li>• Development of interview guides based on initial observations and initial CoMe data</li> <li>• End of Interview and Observation Sequences for teachers and other adults</li> <li>• Second Parental Interview</li> <li>• Child Interviews and</li> <li>• Possible 2<sup>nd</sup> Scheduled Visit to alternative test school site for interviews and formal observations</li> <li>• Questionnaire completed by other test site schools</li> </ul>	<p>CoMe Data Analysis</p> <p>Informal and Formal Observations</p> <p>Interviews</p> <p>Questionnaire</p>	<ul style="list-style-type: none"> <li>• LSBU Research Staff</li> <li>• Scheduled Time for Teacher, other adult staff, Childrens Interviews</li> <li>• Within class time for children to complete Guided Writing Task</li> <li>• Time for questionnaire completion by teachers at other test site schools</li> </ul>

	<ul style="list-style-type: none"> <li>• Children’s Guided Writing Task completed at all test site schools</li> </ul>		
Spring/Summer Term 2010	<ul style="list-style-type: none"> <li>• Initial Data Analysis – transcription and translation</li> <li>• Reporting of Functional Changes for Prototype 2</li> <li>• Initial Thematic Analysis of data in respect of key research questions</li> </ul>	<p>Data Analysis Techniques</p> <p>Reporting Proformas for S/W Developers</p>	<ul style="list-style-type: none"> <li>• LSBU Research Staff in conjunction with consortium partners</li> </ul>
Summer Term 2010 onwards	<p>Methodology revisions for Prototype 2</p> <p>Further thematic analysis leading to publication and dissemination</p>		<ul style="list-style-type: none"> <li>• LSBU Research Staff in conjunction with other consortium partners</li> </ul>

**- Resource Calculation for ALE Research Plan Prototype 1 – Helen Allinson School Staff (significant resource time)**

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Assumption that involved staff are:

Teachers: 5

TAs: 2

Care Workers: 2

Sp&L: 1

Note that this is an estimate of significant resource time that required scheduling, not of all time that be involved or of informal time or time for use of the phone in day to day activities.

<b>- Time Period</b>	<b>- Staff Group</b>	<b>- Task</b>	<b>- Time</b>
<b>- Autumn-Spring Term 2009/10</b>	<b>- Teaching staff, TAs, Care Workers Speech and Language Therapists</b>	<b>- Training in use of Phone – estimate 3 hours per staff member, 10x3=20 hours</b>	<b>- 30 hours across 10 staff members</b>
-	<b>- Teachers</b>	<b>- Teacher Interviews – 4 interviews of 1 hour for 5 teachers 5x4 = 20 hours</b>	<b>- 20 hours across 5 teachers</b>
-	<b>- Teachers</b>	<b>- Child Interviews – 10 interviews of 1 hour max across 10 children</b>	<b>- 10 hours of teacher time</b> (note that interviews may be integrated in to class time and may not require specific scheduling depending on what is operationally appropriate at the time)

-	- <b>Care Workers</b>	- <b>Care Workers</b> – 4 interviews of 1 hour for 2 Care Workers	- <b>8 hours</b> across 2 staff members
-	- <b>TAs</b>	- <b>TA Interviews</b> – 2 interviews of 1 hour for 2 TAs = 4 hours	- <b>4 hours</b> across 2 TAs

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**- Resource Calculation for ALE Research Plan Prototype 1 – Alternative Test School Staff (significant resource time)**

Assumption that involved staff are:

Teachers: 2

<b>Time Period</b>	<b>- Staff Group</b>	<b>- Task</b>	<b>- Time</b>
<b>Autumn- Spring Term 2009/10</b>	<b>- Teachers</b>	<b>- Interviews 4 hours of interviews for 2 teachers, 2x4 = 8 hours</b>	<b>- 8 hours across 2 staff members</b>

## **8.0 Further Details on Persuasive Technology Testing**

In order to evaluate the persuasive potential and effect of the tool set, we will consider three sets of techniques:

1. Log files harvested throughout the test period.
2. Qualitative approaches, in particular observations of use and semi-structured interviews.
3. Quantitative approaches (explicitly harvested), in particular self-evaluation

In addition to analyzing log files and interviews, emphasis is also given to quantitative methods already being used at the test schools. Pupil's self-evaluation is a typical example of this.

All areas are heavily subjects to interpretation. The subject of evaluation is also three-fold:

1. The teacher's interaction with technology and the ways in which this affects their interactions with the students
2. The student's interaction with technology and the ways in which this affects their interaction with their world
3. The context in which the text are carried out. This includes evaluating the actual devices and the qualities of the interfaces over time.

Finally we are especially interested in short and long term evaluation.

- **Evaluation Through Log Files**

The essential question here are frequency, duration, and location (for the handheld devices) of actual use. This yields at least the following questions in relation to the teachers:

- Which functionalities have been used?
- Which have not?
- Are the answers to the two above questions surprising?
- Which functionalities have proven useful?
- Have some of these rendered themselves superfluous? (e.g. what is the lifetime expectancy of a SSSI?)

And to the students:

- The same as above +
- Which functionalities were used? Where and when did the use take place?

The latter question requires gps tracking of the devices, which obviously requires permissions from the users. The results, in turn, may be used to validate the principles of suggestion (at the right time), self-monitoring (at the right time), and simulations in real-world contexts. Similar studies concerning the place of use have been used to shed light on cultural aspects of mobile media. One such study revealed that almost all use of mobile

phones in Japan takes place within the home as opposed to in public places such as commuter trains.

- **Qualitative Approaches**

There are several reasons for placing emphasis on qualitative approaches. Observations are useful to circumvent the say-do problem: even among very skilled users of technology it is common to find a gap between what users actually do and what they say that they do. This is not a matter of trustworthiness, but rather a normal condition surrounding the use of advanced technology. In this case, the situation is furthermore complicated by the fact that although the teachers are very experienced users of such technologies, they should not be expected to be experts in persuasive techniques. In a sense this is about software prototyping in the second power. We are not just looking for usability traits, but for manifestations of PT principles.



When it comes to interpreting the results from the initial analysis of the logs, the teachers play an even more crucial role. Not only are the teachers domain experts and as such vital to triangulating the results, they are in fact an extremely important key to our understanding of the relationship between students and technology. Inasmuch as it is possible, observations and semi-structured interviews should also be conducted with the students. The physical surroundings of these activities must be negotiated between the teachers and the PT experts, but are likely to take place at school. This entails the problem of authenticity: it is often not feasible to in fact observe the use of technology where and when it is actually taking place, precisely because some of the functionalities are meant to be used in specific contexts in order for the student to remain calm and in control (e.g. the SSSI). These situations are to a large extent not predictable in the sense that observation can be scheduled. Other functionalities are meant to be used when the student is alone (e.g. the Personal Trainer) and here again, an observer would risk to disturb the actual use. Interviews may benefit from the analysis of the logs, and should be semi-structured. The preliminary investigations as well as the habitus of the teachers all suggest that open-ended interviews are the most suitable for the job.

- **Quantitative Approaches**

In addition to logging movement and other usage, a few other quantitative methods may be used in evaluating the persuasive effect the HANDS tool set. Logs are per definition covert, and although the existence of this technology is overtly stated and discussed in the information given to teachers, students, and parents, we tend to not think about logging as it occurs. In contrast, both teachers and students are already used to evaluate daily routines in some detail (scoreboards etc.) and it seems natural to incorporate this activity into the HANDS tool set. Here, again, the teachers are vital in interpreting the results of self-evaluation. In fact, the role of the teachers can hardly be overestimated in evaluating persuasive effect with young students with autism diagnosis.

#### Stepwise Evaluation

The evaluation design must take the step-wise introduction of the HANDS tools into account for two important reasons:

- 1) The proposed functionalities of the tool set are most likely too many and too diverse to be implemented at once. This goes for the students as well as for the teachers, and is one of the reasons that we propose to emphasize the use of HIPD and SSSI in the first prototype.
- 2) There are bound to be significant differences between prototype 1 and prototype 2. A number of more advanced functions may be implemented in the second version, and may indeed come about as a result of the first round.

The implication is that the two rounds of testing and evaluation cannot be directly compared.

- **Regarding Prototype 1**

The first round of evaluation will naturally focus on matters regarding implementing the technology. In addition to testing factual matters such as use and response to use, this evaluation must also focus on what happens when you introduce new technology into the lives, especially of the students. The schools have different practices regarding the use of mobile phones prior to the HANDS project. It is therefore reasonable to assume that various concerns related to the common use of such technology will arise. It is essential that such issues are addressed appropriately in the evaluation at each school. For example, in cases where there is no existing practice with respect to mobile phones, it is likely that unintended use will occur, perhaps even usage that will disturb teaching. The mere presence of technological gadgets calls for attention, especially when it is relatively new, and introduced into environments of young people. There may also be very positive effects of introducing such technology, i.e., eagerness to share and compare uses of the devices. The news-value will inevitably wear off, at which point a more regular use may be observed. It is expected that these effects will differ from school to school. With respect to evaluation, three concerns arise.

1. Existing ICT practice should be accounted for as clearly as possible. Special attention should be given to areas where the phones may replace existing tools. The phones may for instance replace digital cameras and MP3 players and radios. This is not, however, necessarily the best solution.
2. Early stages of use may be infused with exaggerated enthusiasm and / or frustration. Accounts of this should be taken into account in the evaluation, but not necessarily attributed to the HANDS toolset.
3. As the news-value recedes, the more “real” use will emerge. This would typically imply a reduced use of certain features and an increased use of certain other features. To some extent, this should not necessarily be attributed to the HANDS toolset.

- **Regarding Prototype 2**

When the second prototype is to be evaluated, issues of implementation will be different. In the first place it is different because it is easier to integrate an upgraded version of something than to implement completely new solutions. And in the second place it is different because all parties involved have already been through the cycle once. It is reasonable to assume that both teachers and students will experience a higher level of reflective awareness regarding the technological solutions in the second version, simply

because they have done it before, and at this time it is easier to build communicative bridges between developers, users and evaluators. Since prototype

- **Plan of Evaluating**

The evaluation of prototype 1 serves a dual purpose. In the first place, the evaluation is designed to investigate persuasive effect and potential. And in the second place, this evaluation is designed to systematically collect experiences in order to expand the functionality of the toolset in prototype 2. A similar outlook can be said to apply to the evaluation of prototype 2. As well as investigating and verifying the persuasive effects of the second prototype, this round of evaluation is aimed at extracting design principles that may extend beyond the project, and into future research and development in comparable projects. As indicated in the sections above, a natural flow of investigation will take its point of departure in the actual use in the HANDS toolset, and informed by these quantitative data move into qualitative methods in order to thoroughly interpret the data. The system log-files will deliver information about the teacher's use of the system as well as of the student's use. Since many important elements in the information ecology escapes quantification it is essential that the interview guides are not solely crafted from the hard data, but inspired by it. Social stories that are not longer in use may have achieved their goal, or they may not be used because of flaws in their making. Quantitative data will reveal this. Another interesting issue that can only be evaluated by qualitative methods, is the question of which elements are best served in digital form, which in analog form, and which in a combination of the two. The evaluation will follow these steps:

- The log-files are collected and initially sorted.
- The logs are investigated for indications of aspects of persuasion (section 2 in this document), and with respect to the persuasive principles and their interrelations (section 3 and 4 in this document).
- Interview guides for semi-structured interviews are prepared based on these findings.
- Teachers are interviewed, and if possible and appropriate, observations are conducted.
- Students are interviewed, and if possible and appropriate, observations are conducted.
- Interviews are analyzed and triangulated with observations and logs.
- Results from interviews are verified by the interviewees in condensed form.
- The final evaluation report is written. This includes recommendations for prototype 2

During the spring of 2009, test protocols will de be crafted and presented to the Ethical Board for approval.

- **Resources**

The evaluation of the persuasive effect and potential will avail itself of log-files from all four schools. On sight Interviews and observations are conducted at Egebakken (Denmark) and Svedanskolan (Sweden), but not at the Helen Allison School and Autism Foundation. It is likely that the log-files and the interviews give rise to questions concerning the schools in the UK and in Hungary as well. To the extent that it is feasible, these matters will be settled through online communication with respect to prototype 1. On sight interview sessions will have a duration of approximately 1 hour per session. It should be noted that the validation of data collected through interviews also takes time. The workload for the interviews for the teachers thus amounts to roughly 1.5 hours per child participating in the test. In prototype 1 this applies to Egebakken and Svedenskolan. In prototype 2, this applies to all four schools. Since observation should be as noninvasive as at all possible, it is required that the respective teachers assist in these sessions. It is also crucial that teachers assist in interpreting the data. Relatively few observations are needed, and the workload of the teachers is estimated to roughly 10 hours per school. In prototype 1 this applies to Egebakken and Svedenskolan. In prototype 2, this applies to all four schools. In addition, it is crucial that PD researchers to some extent will have access to minor discussions with the teachers, primarily online. The estimated workload will be relatively small, roughly in the area of 5 hours per teacher throughout the process. Estimate of workload:

Prototype 1		Prototype 2	
Egebakken	30		30
Svedenskolan	30		30
Helen Allison School	15		30
Autism Foundation	15		30

- **Summary of Principles for Evaluating PT**

The concerns and principles covered in this report can be summarized in the following way: With respect to the organizations in which the tests are conducted the following must be taken into account:

- Elements of Indirect Coercion
- Variations in set-up.

With respect to the persuasive situation it should be considered whether:

- The intended outcome is:
  - ⊗ Response-Shaping
  - ⊗ Response-Reinforcing
  - ⊗ Response-Changing

With respect to the actual use (by all stakeholders), it should be considered whether:

- The actual use is:
  - ⊗ Partial Use
  - ⊗ Derived Use
  - ⊗ Alternative Use

With respect to the elements in the tool set it should be considered to what degree the elements (and their interrelations) fulfill their roles as:

- Persuasive Roles of PT
  - ⊗ Tool
  - ⊗ Social Actor
  - ⊗ Simulation

To evaluate these aspects of Persuasive Technology in the context of HANDS, we place To evaluate the effect of HANDS with respect to the information ecology, we place emphasis on:

- Existing practices brought into the HANDS toolset
- Existing practices NOT brought into the HANDS toolset
- New practices brought about by the introduction of HANDS

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