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Design for ageing and disability at Key Stage 4: An introduction to the nature of designing, available teaching materials and resources

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Design for Ageing and Disability at Key Stage 4: An introduction to the nature of designing, available teaching materials and resources.

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Introduction

This paper examines the nature of designing for elderly and disabled people. The paper also provides an assessment structure that may be used to review currently available teaching materials. The aims of the paper are to raise the awareness of design educators to available resources and to provide guidance to support teaching Key Stage 4 of the National Curriculum Design and Technology.

From discussions with design educators it appears that designing for elderly and disabled people are popular areas of study with 11-14 year olds. Focusing on the needs and aspirations of elderly and disabled people can offer educators a mechanism that facilitates a good opportunity for pupils of what it means to design. The need to raise the awareness of pupils to the importance of designing to the making process was highlighted by the recent pilot survey undertaken by National Association for Design Education (NADE). The survey reported that “There was an unsympathetic reaction to written work in what pupils see as a practical subject.” (NADE 1997). The following information details a number of ways pupils can be involved in more interactive methods of obtaining information and formulating a product design specification. The paper is based on the author’s experience of working as an industrial designer involved in the design and development of rehabilitation and assistive technology (RT and AT) products and teaching this topic to undergraduate students of industrial design and technology. (Torrens 1995, Torrens 1996, Torrens 1997) Rehabilitation technology products are those which help an individual regain their physical or cognitive abilities following illness or injury. Assistive technology products help an individual to maintain a level of ability considered normal within their society.

Context

Enabling the end user to appear more real to pupils can make the collection of information more enjoyable for them. The experience of the author is that undergraduate students of industrial design and technology are more positive when working on a ‘live’ project. Focusing on a ‘real’ need, outside an academic requirement, provides interest and motivation to the pupils to achieve ‘a result’.

The areas covered within this paper relate directly to the common objectives of GCSE syllabuses within the area of designing and to the requirements of National Curriculum Design and technology Attainment Target 1 (AT1: designing).

An introductory discussion should take place, before discussing a design brief, to provide a context for pupils working on a project in this field. A critical issue to raise with pupils is that of the stigma that some parts of our society associate with being an elderly or disabled person. Pupils might reflect on the way they and society view elderly and disabled people. Many RT and AT products currently available are rejected by some elderly and disabled people because of the appearance of the product and the image it presents to those around them. (Maynard 1995) A discussion of what it means to be old will help the pupils focus on issues relevant to the user group, such as:

- When does someone become 'old'? (Answer relative to the person providing it, stereotype taken from society).
- How does it feel to be old? (Personal awareness of being old, physical and cognitive ability).
- What happens to your body as you get older? (Reduced joint mobility, less muscle strength, poor eyesight).
- Do children and young adults treat older people differently and why? (Respect, elder abuse).

There are no fixed answers to the questions listed when discussing this values-laden topic. However, pupils should conclude that the needs and aspirations of a disabled or elderly person are no different to their own. They are the same. In answering the above questions pupils may draw upon issues discussed in other classes such as Social Studies.

In addition to the discussion of being old, pupils should discuss their own perception of what might be like to be a disabled person. The teacher should provide a clear definition of impairment, disability and handicap based on the World Health Organisation definitions:

Impairment

Any loss or abnormality of psychological, physiological or anatomical structure or function.

Disability

Any restriction or lack (resulting from an impairment) of ability to perform an activity in the manner or within the range considered normal for a human being.

Handicap

A disadvantage for a given individual, resulting from an impairment or a disability, that limits or prevents the fulfilment of a role that is normal (depending on age, sex, and social cultural factors) for that individual.

(Sandhu and Wood 1995).

Information: building a profile

Once a context for the design activity to be undertaken has been established, pupils can focus upon the user. The pupils should generate questions about the activity of daily living (ADL) to be performed by a user, and the place where the task is to be undertaken. Answering the following questions is an important step towards making the product solution work well and be desirable to the user:

- Who wants the product? (Define user, and user group).
- Why do they want it? (Define ADL, and desirability, does the product fit with the users image of themselves and that which they wish others to see).
- How do they want to use it? (Define if recreational, work, formal or informal).
- Where do they want to use it? (Outdoors or indoors).

It is worthwhile making students aware of the demographics of the elderly and disabled population within the United Kingdom. The graphs in Figures 1 and 2 show the percentage of UK the UK population registered as disabled and the percentage of each form of disability category.

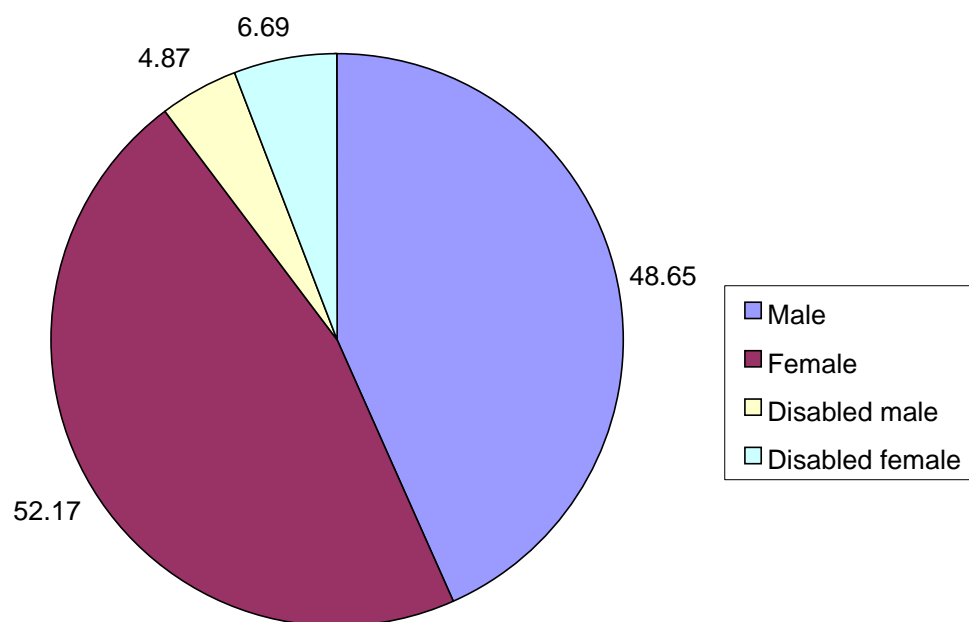


Figure 1: shows the percentage of the United Kingdom Population who are disabled. UK Population total in 1995: 56.76 Million. (Source: Sandhu and Wood, 1995)

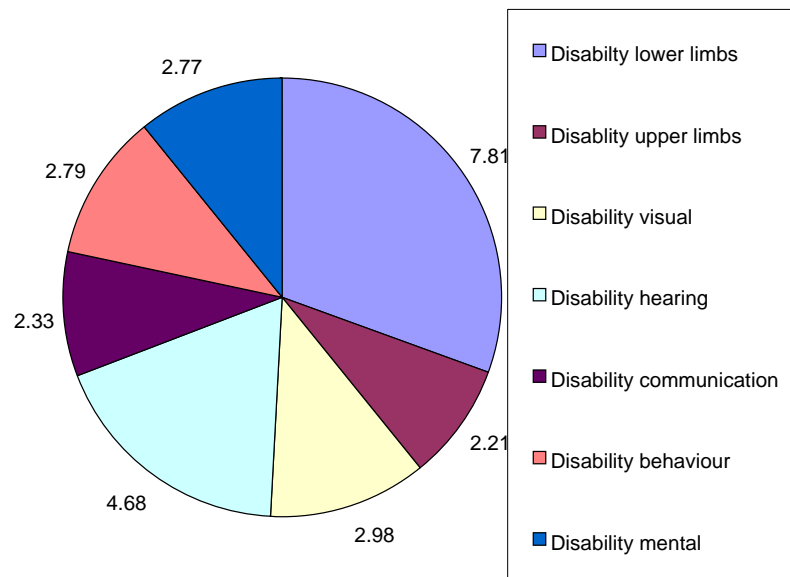


Figure 2: shows the number of people with different forms of disability as a percentage of the UK registered disabled population. Total UK registered disabled population in 1995: 6.56 million (Source: Sandhu and Wood, 1995)

An important point is that there may be a large number of elderly and disabled people, but their needs are so diverse that many products are produced on a small scale, or may be adaptations to existing products. The result of the dispersed market is that RT and AT products are often produced using jobbing workshops. The facilities in such workshops are similar to those available within many schools. This point may be emphasised that the pupils are working within the same constraints of available facilities as professional designers.

Examples of workshop facilities where the production of one-off or small batch production takes place may be found in most local areas within the United Kingdom. Medical physics departments or artificial limb centres good examples, the centres are usually attached to large hospitals. Small, local, engineering companies offer an alternative commercial example for small batch production.

Investigating user needs

Having discussed the overall user group size, available facilities for manufacture, and the issue of desirability there are a number of ways in which the needs of the user can be obtained by pupils, these include;

- Case study Multi-media, World Wide Web, Film, OHP, video, slides.
- Task scenario Task analysis of a subject performing an ADL
- User/ user group Discussion, interviews questionnaire.
- Empathic Reduction of vision, touch, mobility, hearing of the
modelling and designers/pupils.
task analysis

(HUSAT 1996)

The following details will provide an introduction to the resources available to design educators. The available resources will be reviewed using the following criteria:

- Does the resource enable students to practice their IT skills?
- Does the resource provide information appropriate to the level of difficulty of design task?
- Is the resource inclusive of all information required to perform the specified design task?
- Does the resource include examples and in what media format are they presented?
- How difficult is the resource to access?
- How much does the resource cost to access?

Case studies

Using a story about an individual user can be a powerful way of obtaining a lot of detailed information about a user group. There are many groups and organisations that represent individual disabled and elderly people. Most groups are charities and are usually focused on a specific aspect of disability or ageing, such as:

The Arthritis and Rheumatism Council (ARC),

Age Concern England,

The Stroke Association,

Help the Aged,

SCOPE and

The Multiple Sclerosis Society.

Most of these groups have comprehensive background and detailed information about the medical condition and advice on how to people who have this condition might cope with it.

The larger charitable organisations, such as those previously mentioned, have printed material available at a low cost or free. Some, like the ARC have a comprehensive range of printed material, video, slides and an Internet site. (See Figure 3). The Helen Hamlyn Foundation has been involved in the development of a teaching pack for schools and colleges with the research groups and commercial organisations.



Figure 3: shows the range of resource material available from the ARC (including WWW site).

The Design Age Network teaching pack is produced by the Royal Society for the advancement of Art & manufactures (RSA) in conjunction with Design Age, based at the Royal College of Art. The Helen Hamlyn Foundation in part sponsors Design Age. The pack provides an introductory text, slides and case studies for use in the discussion of designing for elderly people. (See Figure 4).



Figure 4: shows the DAN teaching pack.

Task scenario

A task scenario is the description of the sequence of events that make up a daily living task such as pouring a cup of tea. The description may be given verbally, in a written or visual format. Development of a task scenario by pupils enables them to be aware of the issues involved in performing a specified task. A task scenario may be produced by individual pupils or as a group exercise. An activity of daily living (ADL) is chosen, such as cleaning one's teeth and the environment within which the ADL is to be performed is defined. (Turner, Foster, Johnson 1996) The user profile will already be known from an earlier exercise before this stage in the design process. One outcome may be a list of words associated with the task, user and environment. Another may be the discussion by pupils of the inter-relationship between the words generated, shown in the form of a bubble diagram.

User/ user groups

Many volunteers from charitable organisations would be willing to come along to a school and discuss the needs of their members. The discussion of the context of what it is to be disabled or an elderly person, recommended to be undertaken before starting the project, should highlight the need for sensitivity when pupils ask questions of a volunteer.

The larger support groups, such as Age concern, Arthritis Care and The Stroke Association, can be contacted through regional and local branches, listed in UK local telephone directories, charity shop, or day centre in a local high street. Volunteers can be contacted through these outlets following discussion with a regional or local organiser. The organiser will know of a suitable volunteer.

The involvement of a disabled person or group of disabled people could be potentially distracting or disruptive to a teaching session. Pupils require a briefing as to the purpose of the volunteers visit, what are the questions they want answered and what each pupil will be expected to produce as an outcome of the visit. A similar briefing is required for the volunteer. The teacher will be required to keep everyone to the schedule of planned events during the visit. Inviting the volunteer to return to view the pupils work should encourage the pupils to become more involved in their project and will provide feedback for both pupil and volunteer.

Empathic modelling and task analysis

Pupils are, mainly, young fit and active. They have little experience upon which to draw of pain, immobility and frailty. Immobility and the impairments associated with being frail and elderly may be simulated using a number of items often available within a school environment. In Table 1 there are suggestions on how impairments may be simulated.

Impairment	Description of impairment	Simulation technique
Poor mobility walking	Lower limb restricted joint movement commonly due to Arthritis, Spinal injury, Stroke, accidental broken bones.	Use hockey or cricket leg protectors to restrict ankle and knee movement and simulate weak leg muscles. Important: do not allow pupils to restrict blood flow to their upper limbs through over tightening.
Weak grip limited hand movement	Upper limb restricted joint mobility or limited grip strength commonly due to Arthritis, Stroke, Repetitive Strain Injury Spinal injury, accidental broken bones.	Use hockey or cricket gloves to restrict hand movement and reduce finger sensitivity. Important: do not allow pupils to restrict blood flow to their lower limbs through over tightening.
Restricted back movement	Restricted movement of spine commonly due to Arthritis, Spinal injury, Stroke, broken bones	Use hockey or cricket body protector to restrict spine movement. Important: do not allow pupils to restrict blood flow to their limbs through over tightening around the body.
Partial eye sight	Partial sight such as tunnel vision and blurring commonly due to congenital eye defect, accident, cataracts, eye disease.	Use old eye protectors, scuff over lens evenly using fine abrasive paper. Drill a small hole in each lens if simulating tunnel vision. Alternatively use a hockey head protector motorcycle helmet.
Blindness	Blindness , in one or both eyes, commonly due to congenital eye defect, disease (diabetes), accident.	Use blind fold over one or both eyes, or welding goggles.
Poor hearing	Loss of hearing commonly due to exposure to loud noise, disease, congenital defect.	Use a pair of ear protectors.
Voice loss	Loss of voice commonly due to Stroke, disease, congenital defect.	Pupil must not speak during activity performance.

Table 1: provides a guide to simulating different forms of impairment

A detailed briefing, similar to that used before talking to an external visitor, will provide pupils with context for the concepts of empathy and being sensitive to the needs of another person. The briefing will also focus pupils on their aims and objectives for this assignment. Volunteer pupils can be asked to perform specified tasks such as walking around a classroom (with all possible sharp objects removed before starting the task) between chairs and tables or picking up a non-breakable beaker of water. Some pupils would be wearing the equipment to simulate impairments; others would be unrestricted in ability. Pupils should be encouraged to record the task performance of pupils who have no restrictions or impairments with those who have the simulated impairment. They can record the activity through cartoon/ stick figure sketching annotation. Some pupils should time each activity. Pupils can also interview the pupils performing the specified tasks for their opinions on how easy or difficult each task was to perform. A teacher may also employ a video camera or use a digital camera to take photographs to record the task activities for later analysis by individual pupils or a group.

During a debriefing by the teacher the pupils can reflect upon the relationship between difficulties experienced by those who had simulated impairments and those who did not. The pupils can also reflect on how the reduction of ability might affect their product design specification.

Presentation of information and design process

Pupils can present the information gathered and externalise their thoughts on this subject using techniques that complement a written report, such as:

- Lists of words associated with or used by elderly and disabled people.
- Bubble diagrams of aspects involved in the new product or user new.
- Mood boards, showing images of the target user, associated products, lifestyle images.
- Product analysis sketches and photographs of existing products labelled with comments about manufacture (process and materials), ease of use, and desirability.
- Sketches, in a time sequence, (strip cartoon), of a task analysis (ease of use).
- The results from questionnaires used by pupils with a user or user group presented as charts or tables.

An emphasis on the graphical content of the above techniques will help pupils clarify ambiguities in the content of their report. It offers a teacher an opportunity to assess quickly the quality and quantity of investigation produced by the pupil. The graphic representation of their investigation also provides a focal point for discussion between teacher and pupils, or self-assessment, to keep them on course to achieve a successful outcome.

Lists

A comprehensive list of words and phrases can be generated from the discussion. If the teacher facilitates the recording of words and phrases they can become an initial reference point for the whole class. Pupils can contribute and refer to the collection of words and phrases with more detailed information from 'their investigation of other sources. Pupils can prioritise, reduce or enlarge their list, demonstrating their ability to identify opportunities for design and technology activities from which design briefs can be developed'. (GCSE requirements)

Individual pupils or groups can develop the class resource into a product design specification. A user-centred approach to the development of a product design specification is now a common practice in industry. (Lorenz 1990, Ulrich and Eppinger 1996) suitable for a defined user group.

Bubble diagrams

Bubble diagrams can be used to show the interconnection between a diverse range of factors affecting the product design specification of a new product. Working through an example with a group of pupils can be a stimulating experience for them, particularly if they have already collected much of the information about the issues themselves. The pupils demonstrate their consideration of 'the effects and implications of technological activity' (GCSE requirements).

The bubble diagram can be used by a group, or individual, students to help them prioritise the importance of each issue identified within the design brief. The diagram also provides the pupil with assistance in evaluating the effect of changing the specification of one factor on others in the product design specification. (Norman, Riley, Urry and Whittaker 1990) An example is the issues raised within the design of new cutlery for elderly and disabled people (See Figure 5).

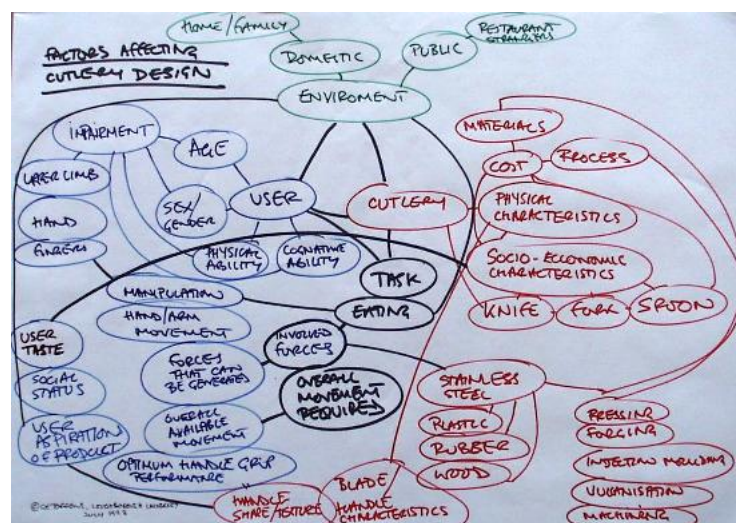


Figure 5: shows the designers perception of the interrelationship of factors within the specification of a set of cutlery to be used by an elderly or disabled person.

Mood boards

A mood board can be used by a designer as an effective method of communicating to others their perception of the social and cultural status of the user and the lifestyle to which the user aspires. The mood board also provides a visual indication of the semantics of the objects that the user associates with achieving their aim of acceptance within a section of their society. In the case of elderly and disabled people the products they use must be seen as desirable for all members of their community and not labelled as a 'disability aid'. Using a mood board will help pupils produce shapes, colours and textures for their product design that are accepted by the part of society in which the user wishes to use the product. The mood board also provides a justification for the use of specified shapes colours and textures by the pupil.

Product analysis

Product analysis or reverse engineering is where the pupil, or group, investigates the specification of an existing product design. Examples of what points to consider and how to display the pupil's findings are shown in *Which*. The magazine, published by the Consumers Association, regularly reviews a range of domestic products. Many UK public libraries stock *Which* magazine in their reference section and so are available to pupils without charge.

Pupils can reflect upon how products, similar to those that they wish to design, are produced and used. Two examples of a product evaluation are shown in Table 2 and Figures 6 and 7.



Figure 6: product analysis undertaken on the range of knives shown.

Spoon sample	Cost £0.00	Weight gms	Build quality	Materials used	Processes used
A	2.50	3.2	3	High impact Styrene handle, Stainless steel utensil head.	Pressed and machine edge finished utensil head, injection moulded handle manually glued onto utensil head using an expoy adhesive.
B	3.25	4.5	2	Stainless steel utensil head, filled Nylon insert, Polyethylene handle.	Pressed steel and machine edge finished utensil head, handle insert injection moulded directly onto utensil. Could be automated assembly or manual injection machine loading. Polypropylene handle manually assembled onto handle insert.
C	1.90	2.9	4	Stainless Steel utensil head, Filled Nylon handle.	Forged utensil head, machine edge finished, injection moulded handle directly onto utensil. Could be automated assembly or manual injection machine loading.
D	2.10	3.5	4	Stainless steel utensil head, filled polypropylene handle.	Forged utensil head, machine edge finished, injection moulded handle directly onto utensil. Could be automated assembly or manual injection machine loading.
E	1.79	6.1	4	Stainless steel utensil head, filled Abyle butene Styrene	Forged utensil head, machine edge finished, injection moulded handle directly onto utensil. Could be automated assembly or manual injection machine loading.

Table 2: shows the product evaluation of a range of Assistive Technology (AT) spoons in the form of a table. Qualitative scales 1-5 can be used to provide a quick guide to a pupil when they have been briefed as to what they consider is very good to very poor build quality.

Sketches/ cartoons

Describing actions or an object through drawing can be a very effective method of communicating a disparate range of information that has a complex inter-relationship within the subject matter. Sketches, however simple, can support and clarify a pupil's written explanation of a particular subject. An example is the annotated description of the product analysis of a range of knives shown in Figure 7.

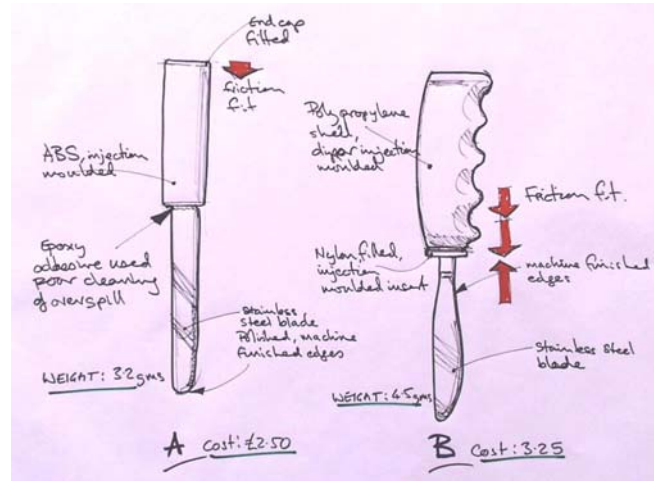


Figure 7: shows the analysis of a range of AT cutlery using annotated sketches.

Stick figures can be a useful indicator to the posture, and sequence of actions, taken by a user during a specified task. The stick figures may be used to provide an indication of the forces acting through the users body to perform a task see Figures 8 and 9. Dividing the body into segments enables simple beam mechanics to be applied to each body segment. The application of simple biomechanics examples can be used to explain why it is easier to hold a heavy object closer to one's body than away from it. Experiments of this nature can integrate knowledge from science classes with real-life applications. The outcomes from such a study will add further information to a pupil's user profile.



Figure 8: shows a user performing a specified task with cutlery.

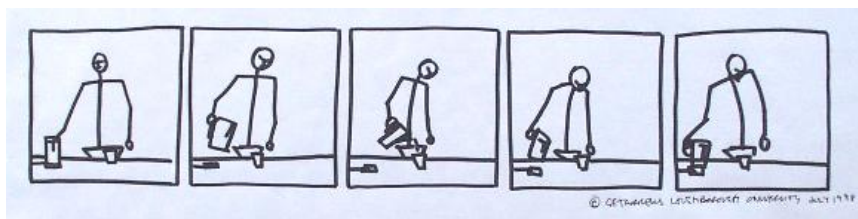


Figure 9: shows a stick figure representation of the user performing the same task.

Presentation of investigation results

Pupils have an opportunity to produce a visually rich written report or poster display through the use of the techniques described earlier. Statistical information may be presented as histograms or pie charts, as shown in Figures 1 and 2. The results of product analysis are easily presented for comparison when annotated sketches or tables are used as shown in Table 2 and Figure 7.

Sketches, as shown in Figure 9, can be used to support a written explanation of a user performing a given task and how it might affect the product design specification.

The externalisation of each pupil's investigation through visual as well as written documentation offers the assignment assessor more information during marking.

Conclusion

Making the product desirable to the end user is as important as making it work well. Design methodologies chosen by a designer to produce a product for able-bodied people are the same as those used when designing for a disabled or elderly person. However, the choices available to the designer of an assistive technology product may be restricted due to a greater need for the product to be easy-to-use.

The techniques described offer the teacher an opportunity to integrate skills, knowledge and understanding, which may arise from other subjects such as science and social studies. The techniques can be set as a group or individual task.

Using some or all of the techniques described in this paper should provide pupils with a diverse range of methods on data collection and design synthesis. Pupils can relate the outcomes from each investigation to their product design specification and a more successful product design.

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Ulrich, K T, Eppinger S D, *Product design and development*, McGraw-Hill, London 1995 ISBN 0070658110

Appendix I

Useful addresses

Arthritis and Rheumatism Council (ARC) Copeman House St Mary's Court St Mary's Gate chesterfield Derbyshire S41 7TD WWW address: <http://www.arc.org.uk/>

Arthritis Care 18 Stephenson Way London NW1 2HD Tel: 0171 916 1500

Age Concern England Astral House 1268 London Road London SW16 4ER

Tel: (0181) 679 8000 e-mail: infodep@ace.org.uk WWW address: <http://www.ace.org.uk/>

Consumers Association,Ltd. 333 High Holborn, London, W.C.1

email: which@which.net WWW address: <http://www.which.net/>

Design Age Network: UK contact: Susan Hewer and Cheryl Kingsland, Design, Royal Society for the Encouragement of Arts, Manufactures & Commerce, 8 John Adam Street, London WC2N 6EZ, United Kingdom, tel+ 44 171 930 5115 , fax+ 44 171 839 5805, email rsa@rsa.ftech.co.uk WWW address: <http://valley.interact.nl/DAN/>

Help the Aged St James's Walk, Clerkenwell Green London EC1R OBE Tel. 0171 253 0253 email: hta@dial.pipex.com WWW address: <http://www.helptheaged.org.uk/>

Multiple Sclerosis Society of Great Britain and Northern Ireland 25 Effie Road, Fulham, London, SW6 1EE. Tel: (0171) 610 7171. Fax: (0171) 736 9861.

The Stroke Association CHSA House Whitecross Street London EC1Y 8JJ

Tel: 0171 490 7999

Usability-net WWW address: <http://www.lboro.ac.uk/info/usabilitynet/>