Investigation of a user-informed standard to promote inclusive design of fitness equipment

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Collaborating Organisation: Inclusive Fitness Initiative

Abstract

Investigation of a user-informed standard to promote inclusive design of fitness equipment

This thesis describes the development of a technical standard to aid in the design of inclusive commercial fitness equipment. It was driven by the Inclusive Fitness Initiative, a charitable organisation leading the way in the mainstream delivery of an inclusive fitness culture in the UK. Confirmation of the widespread inaccessibility of existing products to disabled people is provided through a literature review, which additionally highlights the importance of considering a range of product types and impairment categories in providing a feasible design solution. The review also upholds the thesis' premise that the fitness industry's adoption of more inclusive practices is being hindered by the lack of relevant and coherent design information.

With the inclusive design of mainstream commercial fitness equipment in its infancy, the work necessarily draws on predominantly qualitative and inductive investigation methods. Advocated for use in new fields, a consortium approach was used to develop an inclusive design standard in consultation with relevant stakeholder groups. Data has been drawn from 5 practical testing sessions involving 122 users examining a total of 209 products. Questionnaires have been employed to capture the needs of individuals with a range of physical, sensory and cognitive impairments and the findings used to identify the foremost sources of design exclusion. Concurrently, commercial perspectives on the viability of an industry-specific inclusive design standard have been solicited from 15 equipment supplier organisations, representing approximately 65% of the industry, via a series of 9 focus group sessions. From analysis of the collective data, the first draft of the standard was created by the author. Subsequent revisions were guided by an equipment expert panel, convened to offer professional opinions and synthesise user and supplier data, until a consensus on technical content was reached. Substantive conclusions are drawn from the research with regard to the use of an independent and multi-disciplinary expert panel to mediate between multiple stakeholder groups and to determine a level of inclusion that can be reasonably and practicably achieved. Further conclusions examine the changing attitudes of leading supplier organisations towards new ways of working, with the uptake of the standard, product design changes and feedback from product design staff indicating the efficacy of the research approach in promoting inclusive design practice.

Finally, case study and survey data are presented to confirm the subsequent effectiveness of the standard in supporting inclusive equipment design. The value of the standard is further demonstrated by its inclusion in the bibliography of EN 957:1, the European Standard governing the safety of fitness equipment, alongside the creation of an associated class of product. In addition, the content of the standard has formed a considerable proportion of the new inclusive fitness standard under development by sub-committee WK19803 of the American Society for Testing and Materials (ASTM).

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I am also grateful to the Inclusive Fitness Initiative, Montgomery Leisure Services, the English Federation of Disability Sport, Sport England, Sheffield Hallam University and the IFI R&D Associate fitness equipment suppliers (see pg 8) for funding this project.

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Abbreviations

ASTM	American Society for Testing and Materials
BNQ	Bureau de Normalisation du Québec
BS	British Standard
BSI	British Standards Institution
CSA	Canadian Standards Association
CEN	European Committee for Standardization
DCMS	Department for Culture, Media and Sport
DDA	Disability Discrimination Act
DRC	Disability Rights Commission
EFDS	English Federation of Disability Sport
EN	European Norm
FIA	Fitness Industry Association
GJSF	Gary Jelen Sports Foundation
HMSO	Her Majesty's Stationery Office
IEC	International Electrotechnical Commission
IFI	Inclusive Fitness Initiative
ISO	International Organization for Standardization
IPC	International Paralympic Committee
LIW	Leisure Industry Week
NCPAD	National Center on Physical Activity and Disability
NHS	National Health Service
ONS	Office for National Statistics
R&D	Research and Development
TC	Technical Committee
TSO	The Stationery Office
UKTI	UK Trade & Investment
YMCA	Young Men's Christian Association

Research Papers Published

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Chapter One: Introduction

1.1 Background

The Inclusive Fitness Initiative (IFI) is a pioneering national organisation working in partnership with the fitness industry to remove physical, cultural and communication barriers facing disabled people accessing mainstream fitness facilities (Easton, 2003a)*. The primary objective of the IFI is to ensure that every disabled person in the UK will be able to access an inclusive fitness facility, irrespective of geography or impairment. In accordance with this aspiration, this thesis describes a subset of activities undertaken by the author, in association with the IFI, in relation to the development of more accessible and inclusive fitness equipment. For the purposes of the current work *inclusive fitness equipment* is defined as mainstream equipment that is accessible to, and usable by, as many people as reasonably possible. Specifically this research investigates fitness equipment which is designed for use by both disabled and non-disabled users.

1.1.1 The Inclusive Fitness Initiative

Generally the UK experiences low levels of sport and physical activity participation, with disadvantaged social groups identified as those least likely to take part (DCMS/Strategy Unit, 2002). It is therefore unsurprising perhaps, that national survey data on involvement in sport by disabled young people (Finch *et al.*, 2001) and disabled adults (Sport England, 2002a) reveal significantly lower participation rates for disabled people compared with their non-disabled counterparts, across a wide range of impairment categories. In a specific attempt to redress these inequalities within the fitness industry, the IFI launched as a pilot project in 2001 funded by £1million from the Sport England Lottery Fund. Delivered under the auspices of the English Federation of Disability Sport (EFDS) by Sheffield-based sports consultancy Montgomery Leisure Services,

*References are included alphabetically by author at rear of thesis this programme worked with local authority and not-for-profit organisations to bring new standards of accessibility to 29 public sector fitness facilities located throughout England. Its early success and potential as a catalyst for the development of better facilities and opportunities for disabled people was identified by the UK Government's Minister for Sport:

> *"The Inclusive Fitness Initiative is driving provision for disabled people in public sector fitness, ensuring that as many disabled people as possible throughout England gain access to the countless benefits associated with physical activity. Fitness is an excellent vehicle for addressing inclusion in the purest sense. It is something that we can all achieve in irrespective of ability or aspiration. I hope that in time, inclusive fitness opportunities will cease to be innovative and will simply become the expected norm."*

Rt Hon Richard Caborn MP, Minister for Sport (EFDS, 2002, pg 3)

A further award of £5million from the Sport England Lottery Fund in 2003 for a national rollout to 150 public facilities was followed in 2007 by a grant of £1.95million from the National Sports Foundation for work with an additional 200 public and private sector sites. Interventions were made at each of these mainstream fitness centres to enable them to become more accessible and attractive to a wide range of disabled people. Consequently, the IFI will support a network of nearly 400 inclusive facilities by the end of 2009, with the ambition to impact 1000 facilities by the time of the London 2012 Olympic and Paralympic Games. According to Baker (2001), disability groups across the UK have praised the launch of these first inclusive gyms as a landmark which could radically change gym culture. The IFI is thus seen to be at the cutting edge of developments in this new field of inclusive fitness both in England and also internationally (EFDS, 2002).

1.1.2 The IFI Model of Delivery

Utilising a questionnaire-based research approach, the Gary Jelen Sports Foundation (GJSF) (1999a) proposed that there were five principal barriers preventing disabled people from accessing fitness services in English local authority leisure centres. These were:

1. A lack of physically accessible facilities
2. Little fitness equipment which met the needs of disabled users
3. A lack of awareness amongst disabled people about the benefits of a healthy lifestyle and physical activity
4. Insufficient staff training and knowledge in providing fitness services to disabled people
5. Limited communication, targeting and marketing of fitness facilities to disabled people.

Studies by other researchers identified similar barriers and offered evidence as to the legitimacy of the Gary Jelen Sports Foundation conclusions. The Health Education Authority, for example, determined that "there is very little knowledge available to people with disabilities about the benefits of activity to their main condition or its potential role in preventing secondary complications" (1997, pg 13). Comparable investigations in America by Simunds and McGill (2003) suggest the intimidating atmosphere of most exercise clubs and inaccessible equipment are amongst the most common barriers to exercise, whilst Bennett (2000) highlights staff training inadequacies. A comprehensive and systematic study by Rimmer *et al.* (2004) into the barriers and facilitators associated with participation by disabled people in fitness, concurs with these environmental, professional training and education related issues, whilst identifying additional economic and psychological aspects. Rimmer *et al.* (2004) conclude that access to physical activity venues by disabled people is a complex and multi-faceted issue. What is apparent from all of these studies is that increased participation in fitness activities by disabled people will not be achieved by addressing any single issue in isolation. Correspondingly, the IFI works to simultaneously promote inclusion in the four key areas identified in Figure 1.1 and also outlined below.

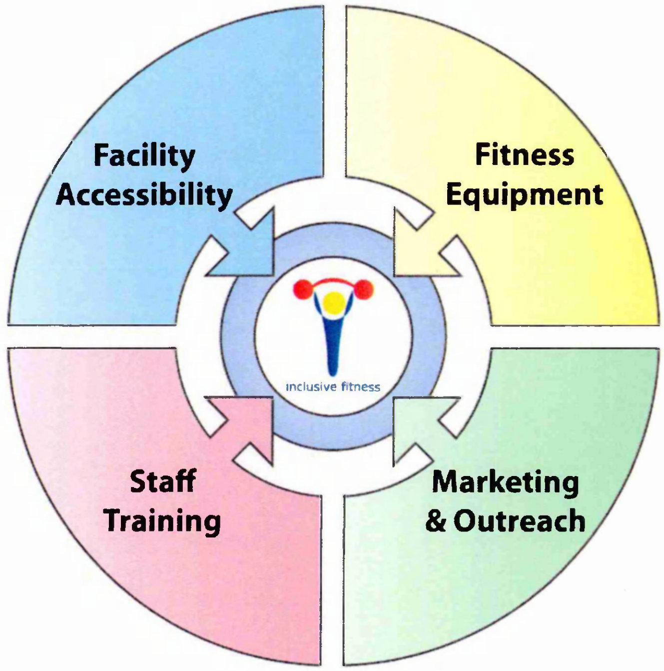


Figure 1.1: Inclusive Fitness Initiative model of delivery

Facility Accessibility: Architectural issues and managerial policies are considered in order to create more accessible venues within which disabled people can participate effectively. Current best practice and legislation are implemented to provide inclusive environments which meet the functional, cultural and communication requirements of a wide range of disabled people.

Fitness Equipment: Installation of fitness equipment that concurrently meets the functional and training needs of both disabled and non-disabled users. The availability of a range of accessible, inclusive products is necessary to facilitate a full body workout for the vast majority of users with impairments.

Staff Training: Training of facility staff to ensure they have the skills necessary to cater for the needs of disabled people. Fitness instructors are offered industry recognised qualifications to provide confidence and competency in creating fitness programmes for disabled individuals.

Marketing and Outreach: Implementation of inclusive marketing strategies to increase disabled peoples' awareness of the opportunities available to them and ensure the fitness industry promotes a more inclusive and accessible image.

It is the author's unequivocal belief that it is only through a concerted effort to simultaneously address these complex and interrelated issues that disabled people will achieve equitable provision and increased participation within the fitness industry. This thesis, however, constrains itself solely to describing work conducted by the author in the area of inclusive fitness equipment design. Specifically, this body of work addresses the development and effectiveness of a user-informed inclusive design standard, intended to offer practical guidance to fitness equipment designers on designing for disabled people. A standalone activity in its own right, this area of investigation is also seen to represent an important and integral element of the IFI's wider organisational work. It is for this reason that all research activities have been embarked upon with the IFI's full cooperation and support. Notably, the IFI's permission to utilise a data set from their fitness equipment accreditation scheme and opportunities to access leading experts in the field of inclusive fitness, have provided major contributions to the research process. Further information about the IFI is provided for interest in Appendix A.

1.2 Introduction to the Study

A desire to address the reported inequalities faced by disabled people in accessing fitness equipment provided the foremost rationale for commencing the current study. The research aims and objectives therefore seek to work collaboratively with disabled people and organisations responsible for the design and manufacture of fitness equipment in order to investigate the provision of more inclusive products.

1.2.1 Inaccessible Fitness Equipment

The Gary Jelen Sports Foundation (1999a) was amongst the first to reveal a widespread lack of fitness equipment suitable for inclusive use within mainstream fitness facilities. Later studies by the English Federation of Disability Sport (2000), Bennett (2000) and Simunds and McGill (2003) all supported this initial finding. The full extent of this problem is explored in the literature review contained within Chapter Two. It is sufficient to note here, however, that inaccessible fitness equipment is frequently cited as being one of the most constraining factors affecting the participation of disabled people in fitness. As the Gary Jelen Sports Foundation (1999a) report advocates, the issue of equipment accessibility is an area which undeniably requires further attention:

> *"The research evidence clearly shows disabled people's difficulty in using a full range of current equipment. Because there is so little equipment available that is designed for inclusive use, this needs to be resolved otherwise disabled use will always remain secondary to the non-disabled user and disabled people's needs will not be met."*

(GJSF, 1999a, pg 29)

Reasons for this equipment deficiency were solicited by the Gary Jelen Sports Foundation from ten major European and US manufacturers at the European Fitness Convention trade event held in March 1999. During these informal enquiries, suppliers indicated that adjustments could be made to specific pieces of equipment to make them suitable for use by different disability groups, but a perceived lack of consumer demand for accessible fitness equipment was also widely reported (GJSF, 1999b). The launch of the IFI would go some way towards raising awareness of market need, being in a strong position to proactively promote the participation of disabled people within the fitness industry. Able to offer over £3million of investment to fund purchases of inclusive fitness equipment for selected gyms in the UK, the IFI now provided a direct incentive to equipment suppliers for developing more accessible products (Baker, 2006). This commercial opportunity rapidly exposed a gap in the knowledge and expertise of the fitness industry concerning the design needs of disabled people. Product design teams commonly had little or no experience in inclusive design and available information was scarce. As yet there was "...no exhaustive list of features which will make items of fitness equipment fully accessible to all disabled people" (Sutton, 2003, pg 97). This shortage of design information was found to not be solely confined to the fitness industry. Those working within the field of inclusive design itself identified a "pressing need for coherent and usable design guidance to enable product developers to access and take advantage of this important new market" (Clarkson *et al.*, 2000, pg 206). In the disability field the Disability Rights Commission (DRC) (2001, pg 5) also identified, across all manufacturing industries, that:

> *"Clear practical guidance needs to be provided for manufacturers which provide, in strictly practical engineering terms, optimal and acceptable ranges for particular and commonly found features of major products."*
>
> (DRC, 2001, pg 5)

Thus, it is the contention of this thesis that contributing to knowledge and understanding of the needs of disabled people in relation to fitness equipment design will facilitate more inclusive practices within the fitness equipment industry.

1.2.2 Equipment Supplier Collaboration

Focusing on the needs of disabled users within fitness equipment design is a unique area for analysis, offering an attractive commercial opportunity to existing suppliers in the mainstream marketplace. To this end, thirteen of the industry's leading manufacturers agreed to participate in a collaborative research project which sought to provide them with inclusive design information directly applicable to fitness equipment. In partnership with the IFI, Montgomery Leisure Services, Sport England and Sheffield Hallam University, these manufacturers (listed over) have provided financial support and access to industry data in order for the author to conduct the research described within this thesis. Recognised as 'IFI R&D Associate' suppliers, this commercial group is estimated to represent over 65% of the UK's fitness equipment supply industry (see Chapter Five). Including UK-based and international operators, as well as varying organisational sizes, between them this diverse mix of companies are responsible for the design, manufacture and distribution of a wide variety of fitness products.

IFI R&D (Research and Development) Associate Suppliers:

Other Participating Partners:

Alongside a range of representatives from equipment supplier organisations, disabled and non-disabled people, health and fitness professionals, independent product designers and other industry experts have all played important roles within the research process. In order to retain a much-needed independent status amongst these often competing stakeholders, it was considered most appropriate to conduct the study within the academic environment of Sheffield Hallam University, under the patronage of the IFI. In the author's opinion, maintaining independence and confidentiality between commercial partners in this way would enable a more in-depth study to be undertaken, as well as contributing positively to the integrity and validity of the work.

1.2.3 Research Aim and Objectives

The direct industrial relevance of the study, combined with the involvement of multiple industry suppliers, necessitated a commercially sensitive research approach to be taken. As far as possible, parity would need to be provided to all involved in terms of access to the study's outcomes and conclusions. For reasons which are justified fully in Chapters Three and Five, it was deemed that under these conditions the most appropriate methodology for providing information to product designers about the fitness equipment needs of disabled people would be the development of an inclusive design standard. The aim of this thesis is thus to test the hypothesis that:

Producing a user-informed, consortium standard is an effective means to support designers in adopting inclusive design practices for commercial fitness equipment.

The intention of the study is to provide information specifically for equipment supplier design staff tasked with implementing inclusive design about the foremost product needs of disabled people, through investigations involving both equipment designers and a range of users with impairments. In order to deduce the validity of the hypothesis the following research objectives were set:

(1) To corroborate a perceived lack of inclusive design information relevant to commercial fitness equipment. This will be achieved through an examination of literature and other pertinent sources.

(2) To identify the foremost sources of design exclusion for a sample of disabled users with a range of impairments. This will be achieved through the practical testing of fitness equipment.

(3) To explore barriers, opportunities and imperatives for the development of an inclusive design standard with representatives from a sample of commercial fitness equipment suppliers. This will be achieved through a series of focus group sessions.

(4) To create an inclusive design standard with consensus on its technical content across all consulted parties. This will be achieved through independent expert panel guidance to equitably synthesise data collected from users and suppliers.

(5) To investigate the impact and effectiveness of the developed inclusive design standard on design practices within the fitness equipment industry. This will be achieved through case study and survey methods.

1.3 Structure of the Thesis

This thesis is divided into nine chapters. Predominantly, material has been grouped and presented by its relevance to each of the five research objectives outlined above. This also represents a broadly chronological approach to the presentation of information. At times, however, it was conducive for data from different stakeholder groups to be gathered simultaneously. Figure 1.2 offers the reader a broad indication of these concurrent events, the chapter within which they are considered and also the research objective with which they are primarily concerned.

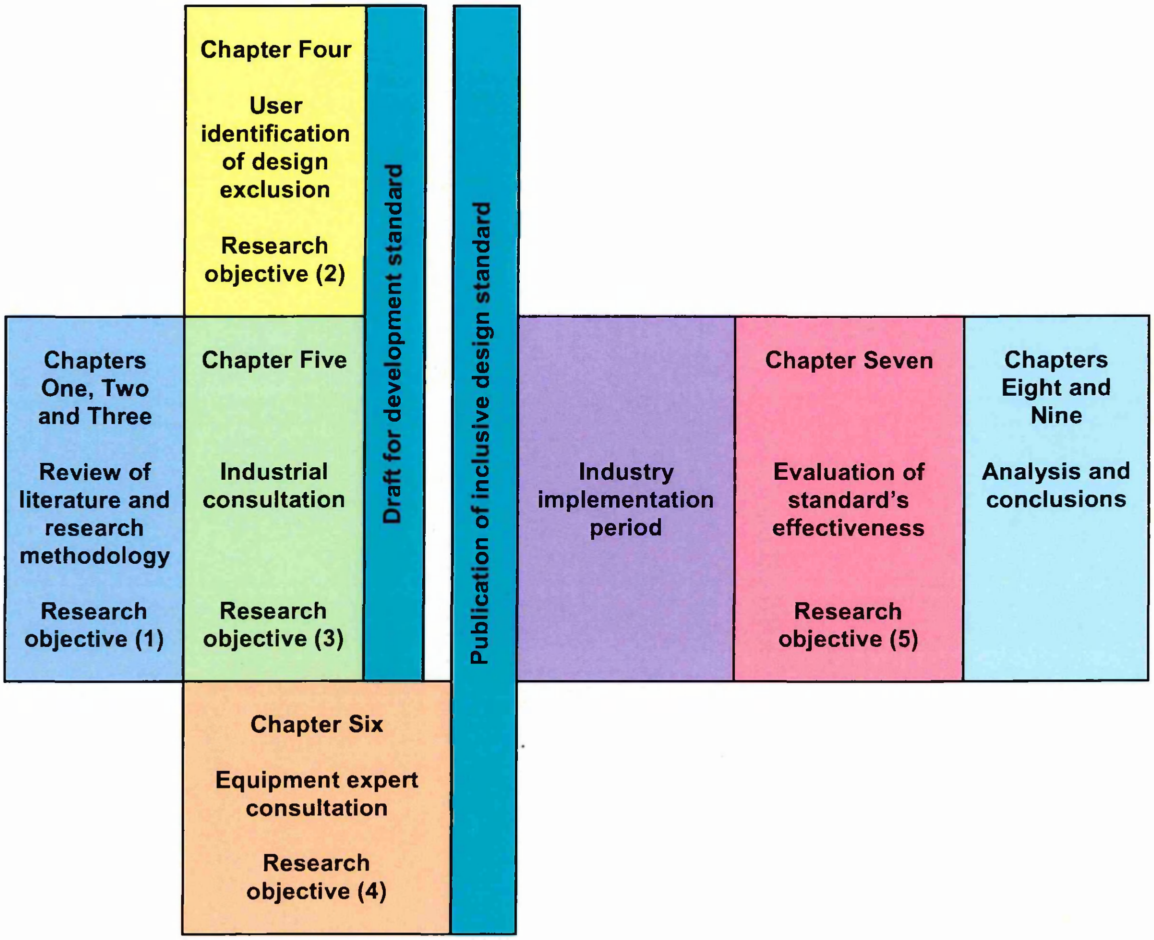


Figure 1.2: Overview of concurrent research events

The chapters of the thesis are structured as follows:

Chapter One – Introduction

Chapter One acts as a foundation to the main body of the thesis. It broadly outlines the context, significance and intent of the research in relation to providing fitness equipment designers with increased information concerning the design needs of disabled people.

Chapter Two – Literature Review of Research Issues

Chapter Two first assesses the present state of the fitness equipment industry with respect to accommodating the needs of a range of disabled users. Low participation rates are identified for disabled people in physical activity and reports are examined which suggest inaccessible fitness equipment is an important contributory factor constraining their involvement. Specific shortcomings of current fitness products are relayed, as is the shortage of practical information available to aid designers working on the development of inclusively designed products. This chapter provides a major contribution to the fulfilment of research objective (1). In outlining the significance and gravity of the unmet need for knowledge and information, a justification for the study is also given. With the nature and extent of the problem established, the chapter goes on to give an informative account of the discipline of inclusive design and also of consortium standards.

Chapter Three – Research Methodology

Chapter Three outlines the various methodological approaches used to carry out the research. It additionally offers a detailed rationale for the selection of a design standard as the preferred dissemination methodology for inclusive design information across multiple supplier organisations.

Chapter Four - User Identification of Existing Design Exclusion

Chapter Four discusses both the methods and outcomes of establishing disabled users' needs for the design of fitness equipment. Utilising an inductive research approach in the form of practical product testing, with data collection via questionnaire from a sizeable sample of disabled individuals, conclusions are drawn on the foremost sources of design exclusion. Collation of data across a series of cross-sectional studies contributes to the realisation of research objective (2) and provides the underlying technical content for the inclusive design standard.

Chapter Five – Industrial Consultation on an Inclusive Design Standard

Chapter Five describes ethnographic investigations involving several fitness equipment supplier organisations, with data gathering through focus group and observational analysis techniques. Critical reasons which have led to the current situation of inaccessible equipment being widespread in the marketplace are explored, together with the industry's state of readiness for change. Prevalent attitudes towards the development and usefulness of an inclusive design standard are scrutinised, along with suppliers' major concerns and imperatives for this type of standard. This chapter primarily sets out to fulfil research objective (3).

Chapter Six - Achieving Consensus on Content for the Inclusive Design Standard

Chapter Six details the 7-phase development process implemented to equitably merge data sets collected from both user and supplier stakeholder groups. A procedural commentary is provided on the use of a committee of technical experts in order to agree a single set of recommendations on inclusive fitness equipment design. Particular emphasis is placed on conveying decision-making processes and conflict resolution strategies employed to gain consensus on the final technical content of the inclusive design standard. Publication, dissemination and promotion of the resultant standard are also dealt with in this chapter. Through synthesising similar and disparate stakeholder requirements, this chapter addresses research objective (4).

Chapter Seven – Evaluating the Effectiveness of the Inclusive Design Standard

Chapter Seven presents the results of evaluative work on the effectiveness of the inclusive design standard in supporting more inclusive product design practices. After allowing the industry a suitable timeframe for implementation, case study and survey data are utilised to explore the impact and value of the standard. As such, this chapter directly addresses research objective (5) and provides significant evidence with which to consider the validity of the thesis' governing hypothesis.

Chapter Eight – General Discussion and Conclusions

Chapter Eight reiterates the objectives of the research and discusses the extent to which each has been met. The major findings of the study are revisited and chief conclusions presented in the form of a reflective and critical commentary. The legitimacy of the original hypothesis is considered in detail, particularly within the context of a commercially competing supplier group.

Chapter Nine – Key Conclusions and Contribution to Knowledge

Chapter Nine draws the thesis to a close by consolidating the key research findings in relation to their original contributions to knowledge. Implications and opportunities for future work are also presented.

Chapter Two: Literature Review of Research Issues

2.1 Introduction

Chapter One introduced the context, as well as the significance, of the research undertaking to provide fitness equipment design staff with practical recommendations concerning the design needs of disabled people. The current chapter reviews the diverse subject areas which must be addressed in order to accomplish this task. As there is insufficient literature devoted to the exact subject matter, this chapter considers the key concepts pertaining to the study in order to lay a foundation for the research. Authoritative studies by notable writers and academics in their respective fields are presented to convey principal ideas and introduce existing precedents which have affected the course of the investigation.

To begin with, the present state of the fitness equipment industry is examined with respect to accommodating the needs of disabled users, which reports a widespread problem with inaccessible equipment and a scarcity of information for designers to address the issue. In this sense, Chapter Two contributes extensively towards fulfilling research objective (1), by corroborating a perceived lack of inclusive design information relevant to commercial fitness equipment.

With the current position established, evidence is presented which outlines the reasons why the fitness equipment industry should consider the needs of disabled people, and why inclusive design information should be developed to support them in this endeavour. In particular, the discipline of inclusive design is introduced as a viable approach to achieving more equitable fitness equipment provision for all users. Finally, the chapter investigates the consortium approach to developing technical standards, as this represents the dissemination methodology adopted for the results of the research.

2.2 Existing Provision for Disabled People

Reliable research into the physical activity levels of disabled people is scarce, but Heath and Fentem's comprehensive summary of work to date concludes that "in general, people with disabilities are less active than persons without disabilities" (1997, pg 195). This is a scenario reflected within the UK fitness industry, where many gyms attract a negligible number of disabled users (Easton, 2003b). The foremost reason attributed to this is the widespread inaccessibility of fitness facilities. Whilst little empirical research exists, there is much qualitative and anecdotal evidence which reports provision to be poor. Various reports suggest that unsuitable equipment is a significant barrier to disabled people's participation in fitness, and that a lack of relevant design information about this population is inhibiting the industry's ability to respond.

2.2.1 Accessibility of Fitness Equipment

Access4fitness describe training facilities for disabled people as not only being "sub-standard", but "practically non-existent" (2001a, pg 22). Their report, which utilised telephone interviews and surveys with 100 public and private sector health club managers, 18 head office representatives from leading health club chains and an undisclosed number of disabled people, concluded that few disabled people had access to the UK's 4,300 fitness centres. Hollis (2003, pg 28) concurs that "most clubs and classes still only target able-bodied exercisers". This is a problem which is widely reflected in the design of mainstream fitness equipment. The seminal work in this area was published in 1999 by the Gary Jelen Sports Foundation and concerned itself with "the degree to which fitness facilities and their equipment could be accessed by disabled people" (1999a, pg 4). Their analysis, based on survey data from 106 active and non-active disabled 'users' and two 'provider' surveys involving 133 Chief Leisure Officers and 290 local authority facility managers, found that only 8.8% of facilities indicated any investment in fitness equipment suitable for disabled people. This lack of investment was despite disabled people being regarded as a key market segment by the majority of centres (GJSF, 1999a). As Sport England reports, it is definitely "the exception rather than the rule for equipment in fitness gyms to be usable by disabled people" (2002b, pg 58).

The vast majority of fitness facilities offer opportunities for both cardiovascular (heart/lungs) and resistance (muscle strength) training. In order for disabled people to participate in a well-rounded fitness programme, a range of cardiovascular and resistance equipment must be available and accessible (GJSF, 1999a; Sport England, 2002b). However, there is little evidence to suggest that a full range of user requirements are currently catered for within either product category. Cardiovascular equipment, such as treadmills and bikes, is widely criticised for an over concentration on lower limb exercise. Rimmer *et al.* (2004, pg 421) found that a common recommendation from a series of focus groups with fitness professionals and disabled consumers was the provision of more "upper body aerobic exercise equipment", as complementary machines for wheelchair users are generally lacking. There are also calls to reduce the effort level required to initiate or maintain cardiovascular exercise, such as the starting speeds on treadmills, because the current requirements are too high for some disabled people (Disabled Motorist, 2004). Further criticisms of cardiovascular products are that they have too many settings and adjustments which cause confusion, and that displays and buttons are difficult to read (McGough, 1999; Rimmer *et al.*, 2005). The construction of many resistance products is also problematic, with Petrick (2002) and Rimmer (2005a) both describing challenges for a variety of mobility impaired individuals when manoeuvring or transferring onto these units. Bennett (1999) provides a specific example by way of upper body equipment where seats are normally fixed firmly in place, meaning they cannot be removed to make space for wheelchair users to access. Weight settings are also criticised on resistance products for being difficult to reach, not starting light enough for disabled individuals with reduced strength and for being labelled with text which is too small to be read by those with visual impairments (McGough, 1999; Bennett, 1999; Rimmer *et al.*, 2005). Requests for larger handles and straps to assist people with limited grip to hold on to are also cited (McGough, 1999; Rimmer *et al.*, 2004).

Due to the access barriers caused by equipment, Holmes (2002, pg 14) asserts that using a gym may be "physically impossible" for some disabled people, whilst Able (2005, pg 41) goes so far as to say that many fitness centres have "equipment that would be difficult or even dangerous for people with mobility or sensory impairments to use". What is clear is that there are various and prolific design features making existing fitness products inaccessible to disabled people. The evidence points strongly towards the need to put in place better equipment provision for disabled participants, which includes both cardiovascular and resistance products. This thesis therefore concerns itself with providing design recommendations for both equipment types, rather than focussing on a single item or type of product.

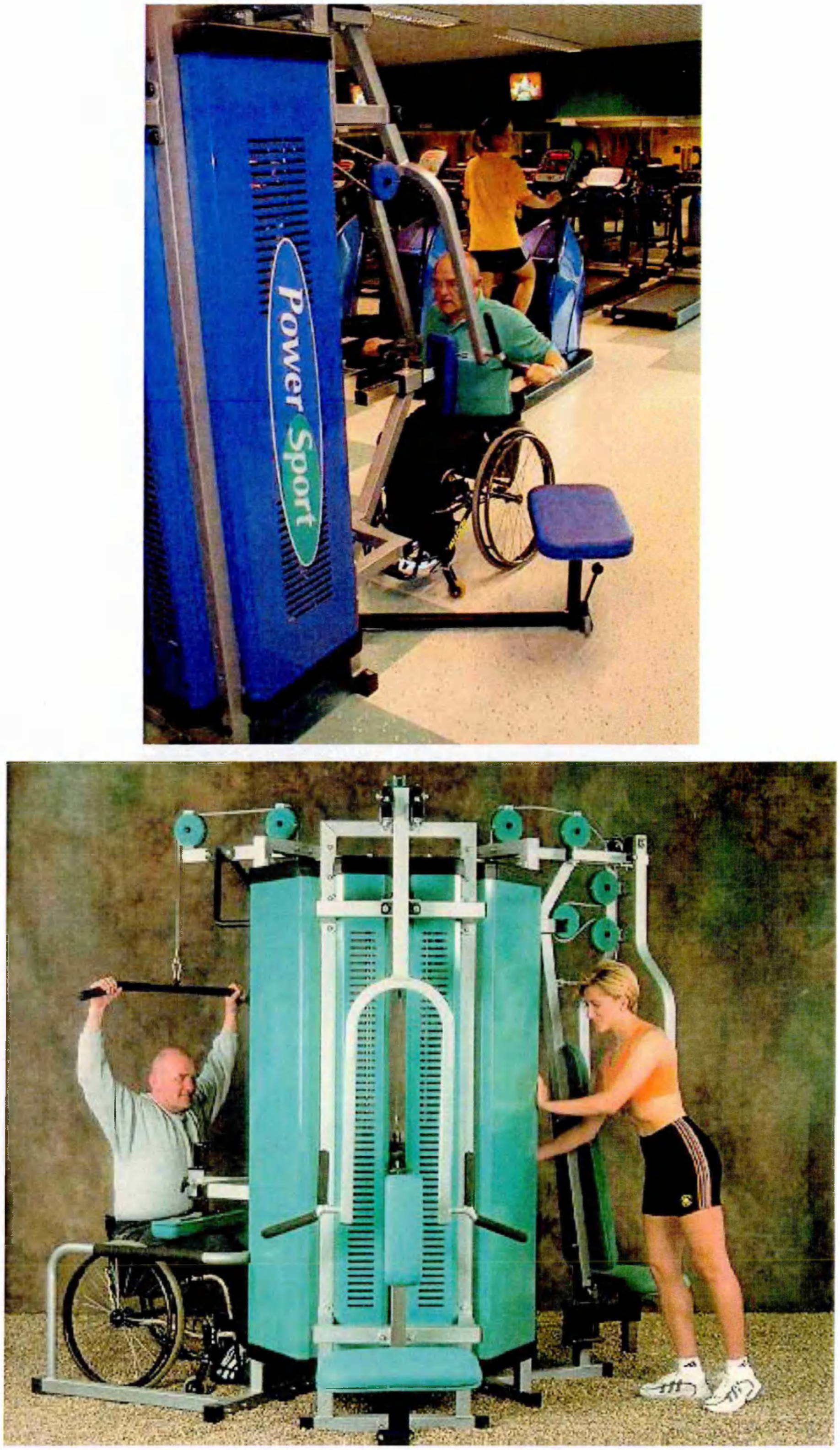
2.2.2 Previous Efforts to Design for Disability

The preceding section generally upholds the Gary Jelen Sports Foundation view that "there are currently very few developments in respect of fitness equipment and its suitability of use by disabled people" (1999b, pg 1). This does not mean that attempts have not been made to better accommodate the needs of disabled users within fitness equipment design. To inform the present research, these previous efforts are reviewed to provide insight and to educate as to their successes and shortcomings.

As exercise for disabled people has historically been provided through physiotherapy and rehabilitation centres, the majority of equipment intended for use by this population is specifically designed for them. Often targeted at specific user groups with particular impairments or injuries, it is not merely standard equipment that has been modified, so is rarely found in health clubs (Bennett, 2000). This first generation equipment therefore does not enable disabled people to exercise alongside non-disabled counterparts in a non-medical environment. Although some rehabilitation equipment has been refined and simplified to cross over to the fitness market, these products have many disadvantages. Bennett (1999, pg 33) reports that they often "require fussy adjustments and professional supervision – not to mention that they were produced in small quantities for the healthcare industry and were, therefore, expensive". High purchase costs combined with small perceived market sizes result in unfavourable returns on investment being projected by club operators. Availability is consequently limited and most adapted medical equipment that has crossed over to the fitness market has therefore achieved minimal success (Rimmer *et al.*, 2004).

A very small number of mainstream fitness equipment companies have ventured tentatively into the disability market. In the UK only two non-medical equipment suppliers were found to have actively tried to address the needs of disabled people in any way. Howard Davies of PowerSport, seeing "potential for disabled users to be able to access gym equipment by creating machines which could be used by able bodied and disabled alike", created the innovative 'Integra' resistance equipment range in 1993 (Davies, 2004, pg 4). This development was followed in 1997 by the launch of the 'Equality' resistance equipment range by Pulse Fitness. These two offerings, shown in Figure 2.1, featured modified seating arrangements which facilitated wheelchair access, enabling both companies to set about selling benefits that were years ahead of their time. Financially however, these ranges cost more to manufacture and sold for the same price as standard products but in relatively small quantities (Clowes, 2007).

A conceivable downfall of these early efforts to include disabled people was their concentration on wheelchair users with little, if any, consideration given to individuals with sensory, cognitive or other physical impairments. Wheelchair users only account for around six percent of the disabled population, so as Petrick (2002, pg 4) explains although "some equipment companies have designed and built equipment specifically for use by people who use wheelchairs... because wheelchair users make up such a small percentage of health club users, owners are unwilling to invest the money and space for these machines". Bennett (1999) also describes the risk involved for fitness centres in putting money into what are seen as 'specialised' markets.



Source: PowerSport Marketing Literature, 1993

(a) Integra resistance range by PowerSport

Figure 2.1: Early examples of wheelchair accessible fitness equipment

Source: Pulse Fitness Marketing Literature, 1997

(b) Equality resistance range by Pulse Fitness

Figure 2.1: Early examples of wheelchair accessible fitness equipment

Even in centres offering accessible resistance products, disabled users cannot achieve a complete training programme without comparable developments being made in accessible cardiovascular equipment. Bennett (1999) summarises the vicious cycle which has thus evolved, where disabled people stay away from a club because the equipment is not there, but the equipment is not there because the people who need it stay away. To end this paradoxical situation, a variety of accessible cardiovascular and resistance products must be made widely available in fitness centres. It is concluded from previous attempts to accommodate the needs of disabled people that this will only be achieved if products can be made commercially viable. The present research takes regard of these two factors, firstly through the consideration of both equipment categories and secondly by advocating an inclusive approach to product design, thereby encompassing non-disabled and disabled users across a range of impairment types to maximise market potential.

2.2.3 Scarcity of Design Information

Functional differences must be taken into account when considering the design needs of disabled people. For example, disabled individuals may have reduced muscular strength and endurance, weakness or paralysis occurring down one side of the body, or the complete absence of a limb (Rimmer, 1994; Rimmer *et al.*, 1999). Posture, balance and mobility differences are often found with conditions such as multiple sclerosis or cerebral palsy, whilst arthritis may affect range of motion, grip strength and finger dexterity (McGough, 1999; Rimmer, 2002). For those with neurological conditions blurred vision may be apparent, alongside impaired motor control in the form of involuntary limb movements such as spasm and tremor (Rimmer, 2002). There are also numerous sensory, cognitive and information processing variations to consider. This is a far from exhaustive list, but serves to highlight the variety and complexity of concerns to be addressed when designing for a range of disabled users. Evidence of the overwhelming inaccessibly of products strongly suggests that fitness equipment designers are failing to fully consider these factors. This thesis asserts that a shortage of coherent information about the design needs of disabled people is a key reason contributing to this situation. A deficiency of technical data directly relevant to fitness products is inhibiting the abilities of product designers, as Petrick (2002) rationalises:

> *"The requirements for accessibility of fitness equipment are not as carefully spelled out as those for architectural accessibility. Physical activity and disability is a developing field. There is simply not enough information on the effects of different types of exercise on different disabilities, not to mention what types of movement or activities would be most beneficial for which groups. This lack of research means we do not always know how people with disabilities can use existing equipment, what modifications work best, and what results can be expected."*
>
> (Petrick, 2002, pg 3)

Bradtmiller (2000, pg 543) agrees that for the most part designers "have not deliberately avoided accommodating people with disabilities; they have been hampered by a lack of appropriate anthropometric data on which to craft a truly universal design". In an assessment of the current state of anthropometric research on disabled people Bradtmiller (2000, pg 543) concludes that variability clearly exists compared to non-disabled people but data "is largely fragmented and difficult to use". Many existing studies have sample sizes too small for reliable generalisations to be made about the whole population for the purposes of design, whilst those with adequate sample sizes focus on specific applications, such as seating, so the usefulness of the resulting data is limited. According to Goswami's (1997) review, comparing dimensions amongst studies is also problematic due to little uniformity or standardisation of measurement techniques. A further restriction, outlined by Peebles and Norris (1998), is that data on other abilities also applicable to design, for instance motor skills, perceptual and cognitive abilities, are not included. Whilst there is an irrefutable need for reliable anthropometric data for disabled people, Bradtmiller (2000) outlines the enormity of this undertaking and the extensive resources and timescales associated with this task. In the absence of such data, fitness equipment designers are forced to seek alternative sources of design information.

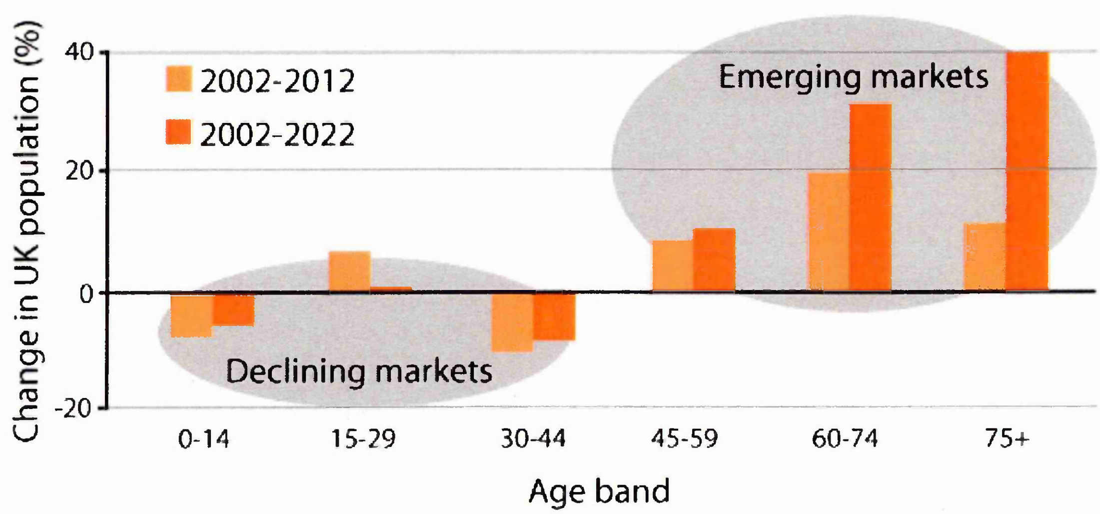
Although literature on designing for disabled users exists, Clarkson *et al.* (2000) concede that its wide dispersion across different specialisms makes it difficult for designers to adequately inform themselves. Their research also suggests that product designers often need guidance in interpreting the available resources. Ekberg (undated, pg 1) suggests that one reason for this is that "in general, accessibility guidelines raise the awareness and understanding of designers and help them ask the right questions rather than to provide specific answers or numbers". The literature tends to offer generic commentaries on design features but provides little in the way of detailed and definitive guidance which can be immediately converted into technical specifications. The current research intends to provide equipment supplier design staff with a more effective resource, in the form of a design standard developed specifically for commercial fitness equipment, to support their adoption of inclusive design practices. This work will address the pressing need identified by Clarkson *et al.* (2000, pg 206) for "coherent and usable design guidance to enable product developers to access and take advantage of this important new market".

2.3 Incentives for Increasing Equipment Accessibility

The focus of this thesis is to provide recommendations to fitness equipment designers as to the design needs of disabled people. The analysis would not be complete, however, without a brief review of *why* disabled people should be considered in the design of such products.

2.3.1 Market Epidemiology

An obvious driver for the inclusion of disabled people in fitness equipment design is the magnitude of this population, with official sources suggesting that there are around 11 million disabled adults living in the UK, equivalent to over 20% of the adult population (ONS, 2004). Population surveys are widely acknowledged to underreport due to 'disability' having no scientific or even a commonly agreed definition, making it a complex and difficult phenomenon to measure (Pfeiffer, 2002). It is likely therefore that the actual number of disabled people is significantly higher than these estimates suggest. While absolute quantification remains elusive, one certainty is that the disabled population is growing. Alongside medical advances and lifestyle changes, the incidence of disability is rising rapidly due to population aging and that fact that prevalence increases with age for many impairments (Prime Minister's Strategy Unit, 2005). Estimates suggest that almost half the English adult population will be over 50 years of age as soon as 2020, making this population an important and emerging market sector, as the data from Clarkson *et al.* (2007, pg 1-21) in Figure 2.2 supports. These demographic factors indicate that the scale of exclusion from inaccessible product design is considerable. Accordingly, the positive impact of addressing this issue is far-reaching.



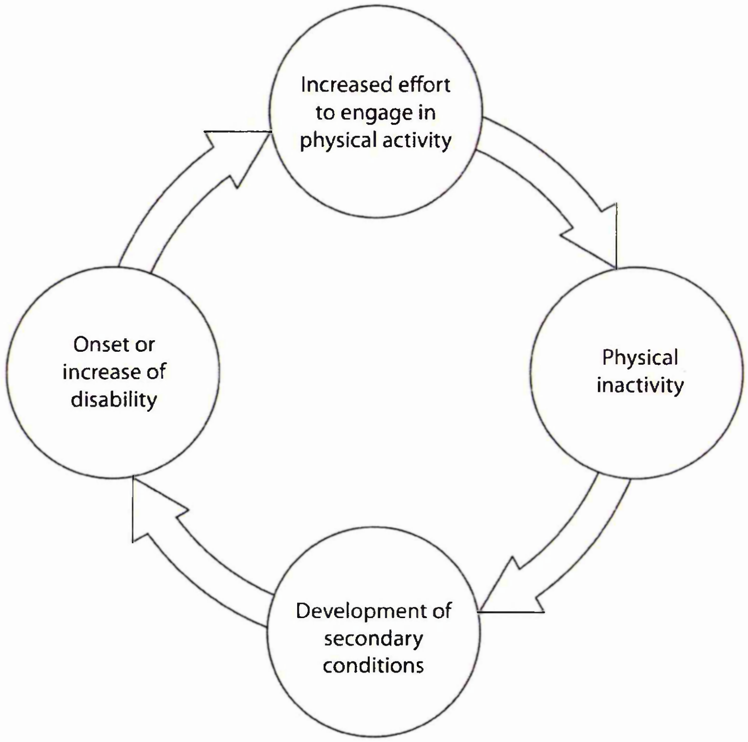
Source: Clarkson *et al.*, 2007, pg 1-21

Figure 2.2: Change in population within each age band over time

2.3.2 Health Promotion

In addition to being a sizeable market, Houldey (2003, pg 20) believes that "most disabled people are eager to improve their health and quality of life through physical activity". Disabled people are highly susceptible to secondary health conditions, such as pressure sores, high cholesterol, obesity, cardiovascular disease, diabetes and osteoporosis, with some studies suggesting incidences of three to four times those found in non-disabled age-matched peers (Pope and Tarlov, 1991; Kailes, 2003). Although excess wear and tear due to variations in standard physiology and the effects of medication may partially account for these differences, physical inactivity is frequently cited as a major contributory factor (Ward *et al.*, 2001; Kailes, 2003; Hoffmann, 2005). Rimmer (2005b, pg 43) describes the worrying "cycle of physical inactivity and disability", shown in Figure 2.3, in which the disabling consequences of inactivity cause secondary conditions as well as compounding the effects of the main disabling condition, inducing further inactivity. Eventually, additional impairment and loss of function can adversely affect an individual's ability to perform daily living activities, eroding their ability to care for themselves and causing a loss of personal independence (Goodwin and Compton, 2004). For these reasons, Rimmer (2002) contends that many of the vast range of potential health benefits associated with exercise have greater relevance and importance for disabled people when compared with the general population.

Due to mounting evidence of the substantial benefits of exercise for disabled people, health promotion activities targeted at this population are increasing (Rimmer, 1999). Alessandri (2000) reasons that one consequence of health promotion activities is a society in which the values of health, wellbeing and physical fitness gain greater importance, in turn creating a demand for fitness services. With a growing awareness of the need for fitness training for disabled people emerging, Rimmer (1999) believes fitness centres are now poised to become the future centres of health promotion for those with impairments. According to Rimmer *et al.* (2005) many outdoor environments are highly inaccessible, hence indoor health clubs are a necessary and viable alternative for disabled people to participate in physical activity. Conviser (2000) also promotes health clubs as excellent purveyors of selected health services due to their geographical distribution, creating ease of access for regular participation, and their excess capacity to meet increasing volumes of interested consumers.



Source: Rimmer, 2005b, Figure 1, pg 43

Figure 2.3: Cyclical relationships between disability and physical inactivity

2.3.3 Commercial Viability

All fitness providers have legislative duties under the Disability Discrimination Act (DDA) (HMSO, 1995; TSO, 2005) to make reasonable adjustments to accommodate the needs of disabled people, yet Easton (2004) believes that inclusion should in no way be viewed as an obligation; it should be viewed as an opportunity. As a consumer-driven business, Easton (2004) argues that it makes sound commercial sense for the fitness industry to be responsive to an increasing desire amongst disabled people to maximise their health. In fact, Hartley (2004) predicts industry growth rates over the next few years will be largely dependent on the success of health club operators' and equipment suppliers' joint efforts to broaden the customer base and grow the market. Older and disabled exercisers are seen as particularly lucrative and loyal sectors of the marketplace that most health clubs have completely overlooked (Houldey, 2003). Not only do these largely untapped markets offer substantial membership potential in their own right, but many of these users will be accompanied by family, friends or personal assistants who may bring added revenue and secondary spend to facilities (Easton, 2005a). Consequently, any short term costs associated with improving accessibility need to be viewed as an investment to meet the needs of a growing number of consumers who will use more inclusive facilities.

2.4 Creating Inclusive Equipment

Equipment is an essential factor in the gym experience, as Rimmer (2003, pg 2) points out: “Let's not forget why people go to fitness facilities in the first place - to use the equipment”. With this in mind, taking an approach which seeks to include the needs of disabled people in design is important, yet it appears that information currently available to fitness equipment design teams may not fully enable them to create truly inclusive products.

2.4.1 Importance of Equipment Design

Rimmer (2003) outlines the importance of having equipment that is comfortable and appropriate in order to draw in and retain disabled members:

> *“It is difficult to imagine why anyone who uses a wheelchair would want to join a local fitness facility. Why spend money on a health club membership that only allows the person access to a few pieces of exercise equipment while the rest of the members have access to all the equipment?”*
>
> (Rimmer, 2003, pg 2)

McDonnell (2005) believes that equipment manufacturers have always helped to define the fitness industry and therefore a strong precedent already exists for utilising equipment design to attract new markets. McGough *et al.* (2004) identify adaptations to make products smaller and less intimidating to female users, whilst Voris (2004) testifies to a recent increase in fitness products intended for use by children. In a similar manner, a clear opportunity now exists for equipment suppliers to draw disabled people towards exercise by proactively encompassing the needs of this population within the design of their products.

All fitness centres operate within spatial and financial limitations, leading access4fitness (2001b, pg 2) to conclude that "inclusive equipment is the way forward, particularly in line with space and cost implications... They save space by eliminating the need for fitness centres to 'double-up' on equipment". Ward *et al.* (2001) agree that there is a place for equipment specifically designed for disabled people, for example in the home or in hospitals or rehabilitation centres, but in mainstream fitness centres inclusive equipment is preferable as it is far more effective in meeting the needs of all. By providing equipment that includes disabled people whilst not precluding others, facilities are able to increase their market size without conceding any existing membership. Furthermore, there is evidence to suggest that inclusive equipment is also more desirable from a user perspective as Harris, an experienced disabled athlete, explains:

> *"I didn't want equipment that was specifically for disabled people - I wanted an integrated range - whereby design features are introduced which enable disabled people to exercise unassisted, so that they too, if they prefer, can be afforded the anonymity normally reserved for able-bodied people."*
>
> Harris (access4fitness, 2001a, pg 38)

In this thesis, the design approach advocated as being most able to achieve this dual usage requirement is that of 'inclusive design'.

2.4.2 The Inclusive Design Approach

The British Standard 7000-6:2005 Design management systems - Managing inclusive design, defines inclusive design as:

> *"Design of mainstream products and/or services that are accessible to, and usable by, people with the widest range of abilities within the widest range of situations without the need for special adaptation or design."*
>
> (BSI, 2005a, pg 4)

The concept originally emerged in the mid-1980s as an extension of barrier-free architectural design (Mace, 1985). Coleman (2001a, pg 46) believes that "thinking on inclusive design is still in its infancy", but according to Keates and Clarkson (2003a) inclusive design is beginning to mature into a respected discipline. Fields such as industrial design and ergonomics have increasingly given users' needs precedence in product design processes which have historically been largely determined by engineering and manufacturing requirements. Supporters of inclusive design contend that many designers "design instinctively for 'able-bodied' young people", resulting in products that are generally difficult to use by elderly citizens and disabled people (Cardoso *et al.*, 2002, pg 47). Coleman (2001b, pg 4.21) describes these users as being simply "disabled by design". The intention of inclusive design is to address the needs of those excluded from or marginalised by these mainstream design practices. Designers are not forced to focus on specialist 'disability markets' but are instead encouraged to expand the boundaries of their current mainstream markets and products. To achieve this, accessibility requirements must be considered from the start of product development, they cannot be addressed in retrospect at the conclusion of the design process (Ekberg, undated).

Inclusive design is founded in a real understanding of the needs and wants of consumers and aims to accommodate the requirements of people of all ages, sizes and abilities. Its advocates are keen to note however, that not all products can be made totally accessible (Keates and Clarkson, 2003a). Consequently, definitions of inclusive design are qualified by a common-sense approach to what is reasonable and by an understanding of what is practical (DRC, 2001). Not only does it make sound business sense to ensure, within reason, that products address the needs of the widest possible audience, it also delivers on the corporate social responsibilities of organisations and offers visible signs of compliance with anti-discrimination legislation. Keates and Clarkson (2003a) and the Disability Rights Commission (DRC) (2001) argue strongly that inclusive design is in fact a necessary feature of all good design. However, despite these benefits, there is at present surprisingly little industry uptake of inclusive design (Clarkson *et al.*, 2000).

2.4.3 Existing Inclusive Design Information

A positive interest in inclusive design was revealed during the I~Design project's national workshop held to examine industry attitudes and barriers to its uptake, which was attended by over 150 participants from a diverse range of UK companies (Keates *et al.*, 2000). Most participants stated however, that they would only implement inclusive design if it was easy to do, or if a consultancy would do if for them, and provided that it did not increase the cost of the product. Dong *et al.* (2003a) similarly concluded that most companies receptive to the idea of designing inclusively, wanted ready-packaged information about product users or to refer to specialists to obtain the user's perspective. While companies agreed with the principles of designing inclusively, Keates and Clarkson (2003a) found that many considered it an impractical method to adopt due to insufficient time or financial resources, and inadequate access to, or inexperience dealing directly with, product users. With these issues in mind, it does not seem unreasonable to suggest that provision of a technical standard, comprised of relevant user information, would help to facilitate an increased uptake of inclusive design practices.

Predominantly, existing inclusive design information appears to be concerned with organisational management processes, or with providing data by which manufacturers can define the potential market size for their products and develop strong business cases. Keates *et al.* (2000) and Clarkson *et al.* (2000) believe that the best way to encourage implementation of inclusive design is to persuade senior management of the need for it, hence it is assumed that by focusing on the market benefits of inclusive design, companies will be more likely to develop new, more accessible products. Whilst this is undoubtedly important, Keates and Clarkson (2003a) also maintain that there is limited use in promoting inclusive design if no guidance is provided on how to go about producing inclusive products. These authors have therefore been instrumental in developing means of assessing the inclusivity of existing products and the ability to quantify the level of design exclusion (Keates and Clarkson, 2003a). As a measure of success for inclusive design, these product assessment approaches seek to determine the number of users excluded from product usage as well as the reasons for their exclusion (Clarkson *et al.*, 2003; Keates and Clarkson, 2003a). Methods commonly involve an analysis of user functional capability scales and physical attributes in relation to the requirements imposed by the product. The assessment results are subsequently mapped onto national population data to provide a quantitative estimate of the proportion of users excluded due to the demands the product places on key user capabilities (Cardoso *et al.*, 2002; Clarkson *et al.*, 2003). Quantifying design exclusion in this manner assists in the visualisation of the scale of exclusion, gives some indication as to its source and also provides a measure of the potential for improvement (Cardoso *et al.*, 2002; Keates and Clarkson, 2003b). Keates and Clarkson (2003b, pg 69) however, acknowledge that whilst it is "useful to know who and how many can use the product, that information will not provide guidance on how to include more". Similarly, Dong *et al.* (2002) believe it is a lack of accessible inclusive design information that still challenges inclusive design practice, whilst Choi *et al.* (2006) hypothesise that one of the reasons for the slow adoption of inclusive design is that inclusive design resources are not adequate for facilitating designers' tasks. According to the Disability Rights Commission (2001) what is accessible often appears to be an uncertain matter of subjective judgement, and designers desperately need support in making inclusive design decisions. Clarkson *et al.* (2000) identity a specific need to further develop knowledge and understanding of the requirements of product end users so that designers are adequately equipped to successfully implement inclusive design. The study presented in this thesis aims to address this need to provide equipment design staff with explicit user requirements through the development of a technical inclusive design standard. Commercial fitness equipment has thus far received little, if any, attention from the inclusive design community and it is therefore speculated that the fitness industry's adoption of more inclusive practices will be supported by providing equipment design teams with specific user requirement data. In taking this approach the research does not explicitly attempt to quantify design exclusion, but instead offers a potentially complementary method of countering design exclusion by equipping product designers with technical guidance on how to include more of the population. This user information will be presented in the form of an inclusive design standard produced specifically for the fitness equipment industry utilising a consortium model.

2.5 Consortium Model Standards

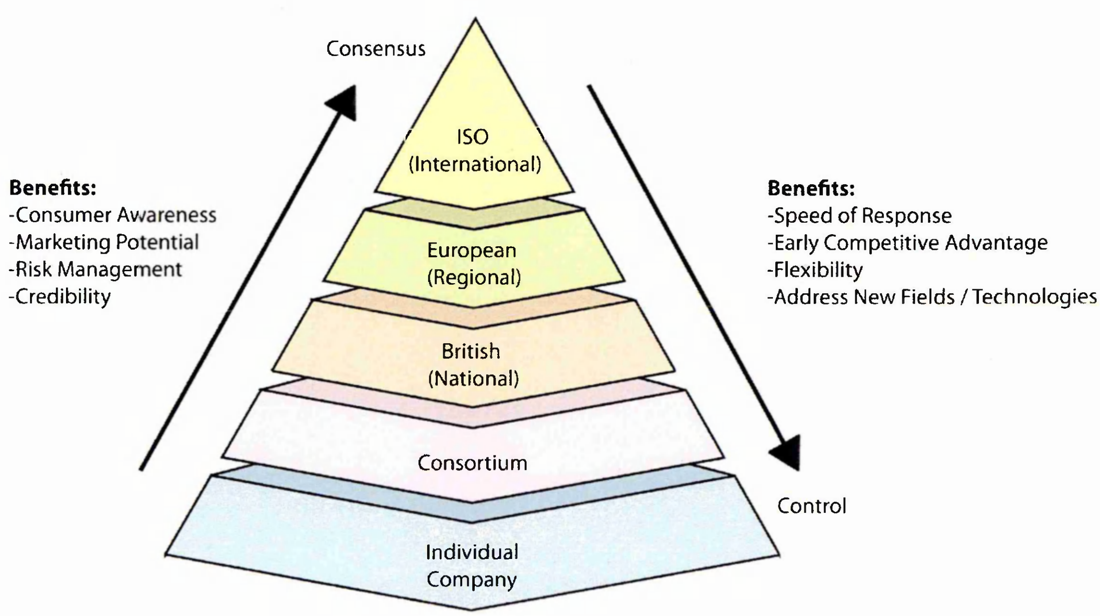
The British Standards Institution (BSI) defines a standard as:

> *"... a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results."*
>
> (BSI, 2005b, pg 5)

Standards are written in response to the needs of those who will use them and where there is a defined market need. They seek to codify good practice through consultation with a wide range of stakeholders and a rigorous development process, and are often regarded by the degree of consensus needed for their development and use. The most widely accepted hierarchy of standards is those developed at international, regional and national level, but it emerged in the 1990s that this traditional structure was increasingly being supplemented, particularly in areas of fast moving technology, by industry-based standards organisations producing consortium standards (ISO, 2003a).

Consortium standards are those developed through consensus amongst a small group of organisations, usually like-minded companies, formed to undertake an activity that is beyond the resources of any one member (ASTM, undated a). Stakeholder consultation typically takes place through steering groups and review panels chosen to be representative and close to the business issues (BSI, undated a).

The International Organization for Standardization (ISO) has criticised consortia approaches for generally only representing agreement between major market players and therefore not having the wider consensus which is typical of their own organisation's standards (ISO, 2003a). They do however recognise that such documents are meeting a market need, due mainly to the fact that they can be produced relatively quickly and are therefore more responsive to the rapid product development and marketing cycles of some industries (ISO, 2003a). Additional benefits of consortium standards include early competitive advantage and strategic influence for companies in new and emerging areas, as well as brand visibility and credibility by sponsorship of good practice (BSI, undated a). The dynamic between standards consensus and control is outlined briefly in Figure 2.4.



Adapted from: BSI, undated a, pg 4

Figure 2.4: The standards consensus / control dynamic

Although offering a narrower consensus, the consortium approach is still widely recognised as an acceptable means to develop standards due to its speed of delivery in new areas and responsiveness to market needs, as illustrated in Figure 2.4. For these reasons this thesis has employed a consortium approach, in association with disabled people, commercial fitness equipment design staff, wider organisational representatives and other industry experts, to develop a standard in the new and emerging field of inclusive fitness equipment design.

2.6 Conclusion

The purpose of this chapter has been to examine the present state of fitness equipment design and to assess the current availability of appropriate design information with respect to accommodating the needs of disabled people. It has revealed that there are few disabled participants within mainstream fitness facilities and that there is evidence to suggest that an important factor constraining their involvement is due to widespread inaccessible fitness equipment. Previous attempts to include disabled users have not reflected the broad spectrum of potential impairments or the range of products required for a well-rounded fitness programme. This thesis seeks to broaden this narrow focus and to maximise market potential by considering the needs of differently impaired and non-impaired individuals, as well as both cardiovascular and resistance products.

Alongside increasing drives towards health promotion, the magnitude and changing demographics of the disability population have been highlighted as reasons why disabled people should be considered in the design of commercial fitness equipment. Within this analysis, it has been identified that fitness facilities are well positioned to become health promotion centres for disabled people and that targeting their latent demand for exercise could prove mutually beneficial. With equipment forming such an essential element of the gym experience, the importance of its design in attracting and retaining disabled users cannot be underestimated.

Having demonstrated a clear demand for the supply of more accessible equipment, the concept of inclusive design is introduced as a socially and commercially acceptable approach that can draw in disabled users without negatively impacting on product usage by non-disabled individuals. Thus far commercial fitness equipment has received little, if any, attention from the inclusive design community and it is therefore contended that the fitness industry's adoption of more inclusive practices is being impeded by a shortage of reliable design information. Due to inconsistencies surrounding definitions of disability and measurement techniques, demographic and anthropometric data are scarce, or worse, inaccurate. In this respect Chapter Two has met research objective (1), examining literature and other pertinent sources to corroborate a lack of information relevant to the inclusive design of commercial fitness equipment. It is inferred that provision of industry-specific data, in the form of a technical standard, would be an effective means of facilitating an inclusive approach, assisting equipment supplier design staff to identify opportunities and respond with confidence to the needs of disabled users. Finally, with the inclusive design of mainstream commercial fitness equipment in its infancy, using a consortium model for the development of the standard is established as being an efficient and responsive approach to addressing these new market needs.

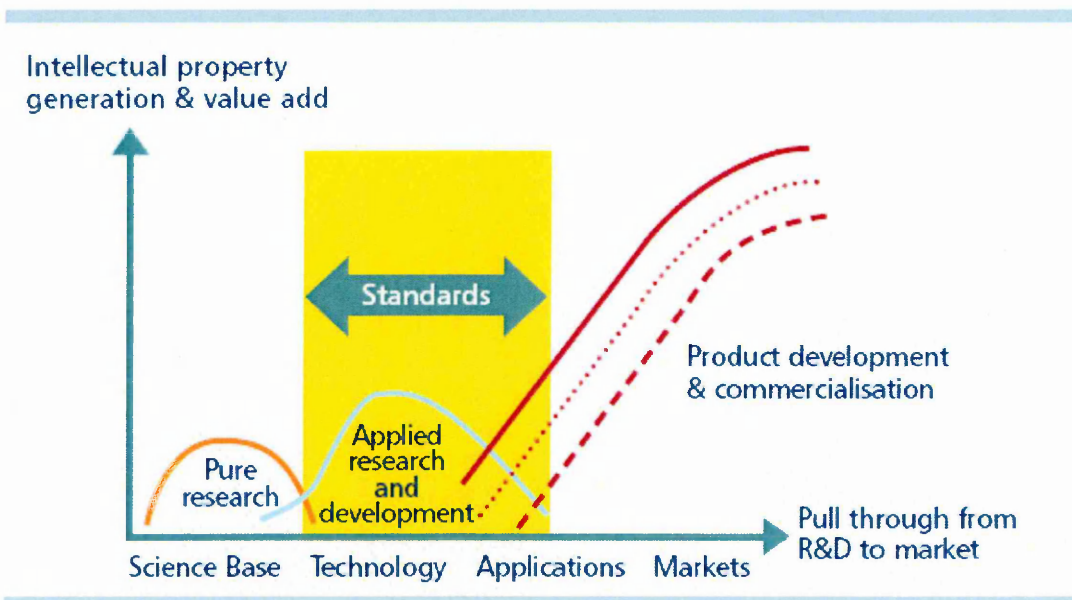
Chapter Three: Research Methodology

3.1 Introduction

The inclusive design of mainstream commercial fitness equipment is a newly emerging field. The current study is therefore presented as an exploratory investigation of the development of standards in this area and also the introduction of inclusive design guidance into an industry. From a methodological perspective, two distinct topic areas needed to be addressed in order to provide recommendations on the needs of disabled people and monitor the effects of their implementation in relation to fitness equipment design. Firstly, a rationale was required for selecting a standard as the preferred medium for disseminating inclusive design data, as well as the identification of guiding principles to govern its development. Secondly, a research design needed to be created which would ensure that the data collection and analysis methods could reasonably be expected to generate appropriate content for the standard and assess its subsequent application by the industry. These topics are discussed in the current chapter.

3.2 Rationale for Development of a Standard

Standards are an important part of the information infrastructure that guides design (ASTM, undated b). Standardisation endeavours to improve the suitability of products for their intended purpose (BSI, 2005b), a key reason for this thesis' assertion that they would be effective in influencing inclusive fitness equipment design. No previously published evidence could be found concerning the use of a design standard to support product designers with the practical implementation of inclusive design, particularly within the fitness industry. There is, however, ample evidence of the critical role standards play in the commercial advancement of new technologies and their influence on product design in a diverse range of alternative industries (ASTM, undated a). As well as assisting with bringing products from development through to market, BSI (undated a, pg 2) advocate standards as being able to "stimulate innovation through the quick and efficient dissemination of critical information". Creation of standards can therefore help to propel an industry forward, making visionary ideas and concepts, such as inclusive design, a reality in the marketplace. The graphical representation offered by BSI (undated a), shown in Figure 3.1, of this pull through from research and development to market, highlights the significant impact of standards in the pre-production phases of product lifecycles. In these early design stages, standards reduce waste from products that will later not be accepted and therefore represent an established and proven methodology to improve efficiency, drive down costs and accelerate time to market (BSI, undated b). According to Peebles and Norris (1998), the application of ergonomic or performance data in particular can quicken the iterative process from concept through to detailed design.



Source: BSI, undated a, pg 2

Figure 3.1: Role of standards in supporting pull through from R&D to market

Figure 3.1 highlights the beneficial aspects of utilising standards in the design process, yet Keates and Clarkson (2003a) urge caution in their use to avoid a culture of minimum compliance, where products are designed to meet minimum requirements only. Arguably, a well written standard should ensure that even at this basic level an acceptable product results. Keates and Clarkson (2003a) additionally believe that designers can find standards dry and uninspiring. The current study therefore aimed to be prescriptive about the functionality required of fitness equipment, without unnecessarily constraining the creativity of product designers by stipulating the exact mechanisms by which these outcomes must be achieved. As with most design tools, the inclusive design standard is not intended for use in isolation or to fully replace user involvement in the product development process. Programmes of consumer testing and evaluation will always be necessary, but the early application of relevant user data should make this a far more efficient and effective experience (Peebles and Norris, 1998). As a common mechanism for the delivery of design information, particularly in the initial stages of product development, standards also offer a familiar format to designers for the delivery of new topics such as inclusive design.

Legislation and regulation are identified by Keates and Clarkson (2003a) as being highly effective long term strategies for encouraging inclusivity within the design process. The root cause of their success is attributed to enforceability and the potential for the application of punitive measures to transgressors. Adherence to most standards is, however, on a purely voluntary basis. Voris (2004) consequently indicates the importance of commercial support for the implementation of standards, making particular reference to the fitness industry:

> *"The standards in the fitness industry are voluntary. It is certainly in a company's best interest to follow the standards that exist but there are no laws that mandate that they do so. Widespread adoption and use of existing industry standards has been growing, and pressure from industry competition will cause this trend to continue."*

(Voris, 2004, pg 31)

The concept of industry competition indicates that standards should have direct commercial relevance and be developed in consultation with appropriate industry partners. As well as implementing a consortium approach to developing the inclusive design standard, this demanded a research methodology with significant stakeholder involvement across a broad range of groups including disabled people, equipment supplier design staff, wider organisational representatives and other health and fitness professionals. It is for this reason that at the outset of the study the author identified six operating principles to guide this discourse and to govern the standard's overall development process.

3.3 Guiding Development Principles

The following six guiding development principles established for the study ensured cohesive, focussed and clear working practices and aims for the standard.

3.3.1 Confidentiality

Shared insight and knowledge capture from communal working would only benefit the development of the standard if those involved felt able to give open and honest feedback. The study therefore aimed to preserve the anonymity of participants, by replacing individual's names with identification numbers during data collection and analysis, and gaining informed consent wherever possible. Commercially sensitive data, which could be traced back to a specific organisation or impinge on intellectual property rights, was handled in confidence, with the author signing confidentiality agreements with the majority of commercial partners. The impact of confidentiality constraints on the research methodology was that findings had to be presented in a generic format, describing overall trends rather than detailing specific occurrences, also necessitating the involvement of multiple participants in every stakeholder group.

3.3.2 Equity

The investigation aimed to provide all interested stakeholders with equal opportunity to participate and, particularly in the case of equipment supplier organisations, equitable access to the research findings. A cross-industry approach, rather than providing bespoke information to each individual equipment supplier, was therefore considered an important aspect of the research design to retain the cooperation of all stakeholders. Simultaneous delivery of information would avoid any single supplier gaining competitive advantage by having an extended lead-in time and would additionally maximise industry exposure to the standard.

3.3.3 Transparent Process for Accreditation

Standards help to ensure consistent product quality and can prescribe the level of accomplishment required for external certification, making their use favourable with accrediting bodies (BSI, undated b). Financial contributions to the research by the IFI came with the remit to provide this organisation with a clear and transparent process by which they could evaluate and endorse inclusive products. The inclusive design standard therefore had to deliver a consistent and repeatable procedure against which fitness products could be appraised. Fixed specifications, with minimal subjectivity, would need accompanying test methods, with obvious pass or fail criteria, to give clear determinants of success. During its development process, essential information regarding the standard would need to be accessible to all parties involved and decisions on its content reached through consensus. Mechanisms had to be put in place to ensure that all views were considered equally, that no one interest dominated and that appeals against decisions were possible. In practice this was achieved through the use of a panel of appropriately qualified experts to make independent judgements on the content of the standard and the inclusivity of product features. The research design was thus created such that it was analogous to the established and respected 7-phase process utilised by BSI (2005c) for the development of British Standards.

3.3.4 User-friendly Format

Inclusive design information had to be presented in a clear and systematic format to assist equipment supplier design staff in identifying accessibility shortcomings. It was important to provide only relevant data and also to avoid information overload about this new design topic. The BS EN 957 series (BSI, all dates) were considered to be the most prominent and well-known safety standards employed by product designers in the fitness industry and as such, the decision was made to replicate this familiar and product-specific style when formatting the inclusive design standard.

3.3.5 Aid to Effective Communication

Clarkson *et al.* (2000) insist that good design guidance must enable the whole range of professionals engaged in multi-disciplinary product development to share and exchange knowledge. Defining terminology and establishing a common language through the standard was considered particularly important for effective communication and to ensure that all decision-making processes were well-informed. Presenting inclusive design information in a written format, which could be shared quickly via electronic communication, was also considered necessary considering the global distribution of fitness equipment design teams and organisations.

3.3.6 Impacts Early in Existing Design Processes

Cost concerns are frequently reported as a major barrier to the implementation of inclusive design (Keates *et al.*, 2000). The author therefore heeded advice from Coleman (2001a, pg 42) to provide "...strategies for identifying and rectifying design exclusion, especially in the early stages of the design process, where the biggest cost savings will be achieved". Direct discourse with industry representatives would therefore be a vital component of the research design to assess their current capabilities and validate the achievability of any new proposals.

3.4 Research Design

The research design was primarily concerned with practical data collection and analysis to enable the study's aims and guiding principles to be met. The strategies and techniques employed sought to produce a research methodology that would ensure valid answers to the research questions posed (Manstead and Semin, 1988). Wadsworth (1998) suggests that when the research aim is to create and sustain change, it is important to encourage the close involvement of those who will directly benefit from the work. Utilising this participatory action research approach is beneficial as those involved often have the greatest knowledge within the area under investigation. A systematic set of studies have therefore been used to obtain information from those stakeholder groups deemed critical in influencing and achieving inclusive fitness equipment design. At the highest level these three stakeholder groups, as Figure 3.2 illustrates, were identified as (a) disabled people, (b) commercial fitness equipment suppliers (predominantly design staff, but also including some non-design related organisational representatives) and (c) health and fitness professionals.

The overall strategy behind the research design was to elicit and codify pertinent information from each group. Systematic and objective filtering methods would then be implemented to draw conclusions regarding the priority design requirements to increase the accessibility of fitness products. Primary data would be collected from disabled users about physical product features causing significant barriers to access, and from equipment supplier representatives as to commercial imperatives for the standard. A combined analysis of these data sets would then enable the author to create a first draft of the content of the standard. With these two stakeholder groups representing potentially conflicting ends of the equipment supply and demand continuum, the health and fitness professionals group would subsequently be best-placed to mediate and guide the standard's technical content until consensus across all consulted parties was achieved. After allowing a suitable implementation period, the effectiveness of the standard and its impact on product design would then be explored with representatives from the equipment supplier stakeholder group.

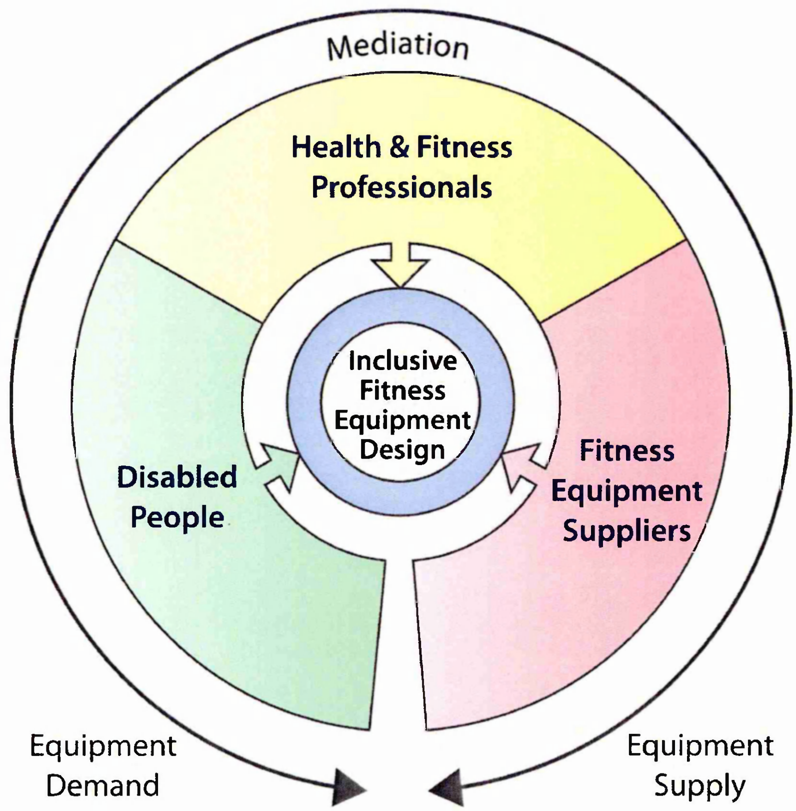


Figure 3.2: Major stakeholder groups considered influential in the design of inclusive fitness equipment

3.4.1 Research Methods

Different research methods were adopted for each stakeholder group, with particular research motives or analytic interests guiding the selection of one methodological approach over another. Empirical methods were favoured with the disabled user stakeholder group to gain raw data on practical product issues, whilst ethnographic and observational methods were applied to elicit more intangible organisational knowledge on design exclusion from the fitness equipment supplier group. In essence, the use of multiple research strategies allowed analysis of the same problem from independent viewpoints, to yield a more complete view and in-depth understanding of the inclusive design of mainstream commercial fitness equipment. With this topic in its infancy, the work is exploratory in nature and thus necessarily draws predominantly on inductive and qualitative research methodologies. It is the research in inductive methodologies which gives rise to the theory, hence in this study trends and determinants from disabled user and equipment supplier data were identified, from which a set of recommendations concerning inclusive fitness equipment design could be generated. Due to the relatively small but focused population samples involved, a qualitative, rather than quantitative, approach was selected to enable a more thorough understanding of the area in question and also to better capture the complexity and dynamism of the setting (Short, 2001). Cross-sectional studies were used to depict the state of the industry at given points in time, whilst longitudinal studies monitored research elements, such as attitudes and opinions, that were expected to change in nature during the course of the research.

For clarity, individual stakeholder studies are presented separately in succeeding thesis chapters. Each chapter provides detailed descriptions of the procedures employed to elicit information from the group under investigation and provides results and discussion on the pertinent issues revealed. However, a brief outline of the specific research methods utilised at each stage is provided below, along with a critique of their merits and justification for use in particular studies.

3.4.2 Stakeholder Studies

(a) Disabled Users

Practical product testing by 122 disabled users was employed to identify specific barriers to equipment usage. Raw data was drawn from a series of cross-sectional studies utilising a simulated gym environment. A total of 209 products were examined, each nominated by individual suppliers as being those that they considered to be most accessible at that time. A sizeable sample of disabled people, selected using combined stratified and purposive sampling methods, was employed to draw conclusions and recommendations on inclusive fitness equipment design relevant to the wider population. Users were recruited, as far as practically possible, from those who should be able to use the products but were currently expected to experience difficulties. BSI (2005a) advocates that most relevant accessibility issues can be discovered using this approach with a comparatively small set of users. Questionnaires were employed to capture quantitative scoring data on predetermined usability criteria, along with supporting qualitative comments from individuals with a range of physical, sensory and cognitive impairments as well as non-disabled people. Averaging of scoring data was used to suggest the products and usability criteria that were particularly problematic for users, in order to focus on priority areas where design changes needed to be made and to guide resources and essential topics to be addressed by the standard. Qualitative feedback was coded and a structured content analysis performed to identify major trends and to reveal the existing physical features which make equipment inaccessible from a user perspective. The author was then able to use the collective user findings from each cross-sectional study to generate a list of the foremost sources of design exclusion. The content of the first draft of the inclusive design standard was subsequently formed from this list. Details of this study are given in Chapter Four.

(b) Fitness Equipment Suppliers

A series of focus group consultations with both design staff and non-design related organisational representatives from mainstream fitness equipment suppliers were employed to explore design exclusion and standardisation from a commercial perspective. To encourage broad industry representation, supplier participation was elicited through an open invitation at trade events and industry press, alongside direct targeting of major manufacturers to secure their involvement. Drawing primarily upon qualitative data, a content analysis of meeting minutes and observational analysis on the part of the author, perspectives on the viability of an industry-specific inclusive design standard were established, alongside common attitudes and barriers to the adoption of more inclusive design practices. Due to the longitudinal nature of the study, it was possible to monitor developments in these areas and in awareness of the benefits of inclusive design. In addition to the provision of organisational information, specific technical contributions to the standard were sought from these industrial partners and the final content negotiated to ensure its commercial relevance and efficacy. Details of this study are given in Chapter Five.

(c) Health and Fitness Professionals

Through a collective analysis, the author was able to assimilate the findings from the disabled user and fitness equipment supplier studies, in order to generate the initial content of the standard. Using a 7-phase approach analogous to the BSI standards development process (BSI, 2005c), as explained in Chapter Six, subsequent revisions were then guided through industry-based participatory action research with key consultants and experts from the health and fitness professionals stakeholder group. The committee included representatives from the fields of fitness equipment design; design legislation and safety standardisation; fitness instruction; inclusive sports equipment design (outdoor adventure) and disability equity. Also included were a user representative and an elected supplier representative drawn from individuals participating in the earlier disabled user and equipment supplier studies, alongside an IFI Programme representative. A purposive sampling approach was used to recruit experts considered able to provide significant data on the research subject (Oliver, 2008).

Successive drafts of the standard were submitted for consideration at committee meetings, after which comments were analysed and the document amended to reflect any agreed changes. The script was resubmitted to subsequent meetings for approval, until a consensus on the technical content was achieved. This procedure meant that expertise from the health and fitness professionals' stakeholder group could act as a filter to the technical content of the standard in order to offer arbitration between conflicting stakeholder requirements and to ensure that only reasonable product adjustments were recommended. Details of this study are given in Chapter Six.

(d) Effectiveness of the Standard

After allowing a suitable implementation period, industry responses to the standard and its use were investigated. Firstly, qualitative case study data, from a selection of products submitted by fitness equipment suppliers and assessed by the author as being fully compliant with the standard, was gathered to evidence changes in current design practices. 'Before' and 'after' examples of product features were compared to show inclusive developments. Secondly, a content analysis was performed on qualitative survey data collected from fitness equipment supplier design staff. Reponses were sought from organisations involved in the earlier focus group studies, and those known to have implemented the design recommendations contained within the standard. This feedback was examined in order to identify trends and provide judgements on the effectiveness of the standard in supporting more inclusive design practices within the fitness industry. Details of this study are given in Chapter Seven.

3.5 Conclusion

Standards are intended to impact on product design, therefore providing justification for their use as a medium to disseminate inclusive design data. In order to draw on expertise and encourage active participation, it was necessary to involve multiple stakeholder groups, resulting in the implementation of six guiding principles to govern the development of the inclusive design standard. The mainly qualitative and inductive research methods used with each stakeholder group defined how the study's objectives would be met and the process by which the content for the standard would be established. This chapter has offered an overview of the methodology and methods involved and subsequent chapters now offer more detailed discussions of each element.

Chapter Four: User Identification of Existing Design Exclusion

4.1 Introduction

The literature appraisal presented in Chapter Two suggests that existing fitness equipment is often inadequate in meeting the needs of a wide range of disabled people. Whilst highlighting an inequality in provision, the literature is unable to provide a sufficiently detailed technical specification, across both a broad spectrum of equipment and different impairment types, to successfully assist product designers to remedy the situation. This chapter therefore describes the inductive research process implemented to collect comprehensive and reliable data from disabled users concerning inaccessible fitness equipment, in order to more adequately inform equipment supplier design staff. The work presented in this chapter aims to fulfil research objective (2), through the practical testing of fitness equipment by a sample of disabled users to identify inaccessible product features and the foremost sources of design exclusion. Warranting a data collection methodology that would allow formal codification of tacit knowledge from disabled users, empirical product testing was selected to identify barriers to equipment usage. A sizeable sample of 122 disabled individuals was used to collect data, draw conclusions and make recommendations on inclusive fitness equipment design relevant to the wider population of disabled people. The data set consists of feedback, collected via questionnaire, from a series of five cross sectional studies spanning a two and a half year time frame.

4.2 Capturing User Needs - Data Collection

The test protocol for each practical session, run under the auspices of the IFI, is explained below.

4.2.1 Test Environment

Two large, accessible sports halls, situated to give both a geographical spread and also access to different tester populations, were chosen for the testing venues. The initial two sessions were held at Aldersley Leisure Village, Wolverhampton and the remaining three sessions at the English Institute for Sport, Sheffield. To illustrate the set-up of the venues, photographs from the latter are shown in Figure 4.1. Key issues for consideration when selecting these venues were; physical accessibility, supplier logistics and the health and safety of all participants, which dictated the use of a simulated gym environment to host the test sessions. Inviting a wide range of differently impaired users to participate in the test sessions made venue accessibility of paramount concern. Within the venue architectural, navigational and emergency evacuation issues were considered to ensure a large sample of users could interact safely and unhindered with the products under test. External influences, such as adequacy of transportation links, accessible parking and availability of appropriate changing facilities, were also taken into account. Geographical and access issues were also considered for delivery and set up of equipment, with loading bays made available for clear entry and egress of equipment by multiple suppliers to the testing locations. The large available floor space facilitated the temporary set up and removal of 30 to 40 individual products per test session, permitting a considerable number and range of items to be used.

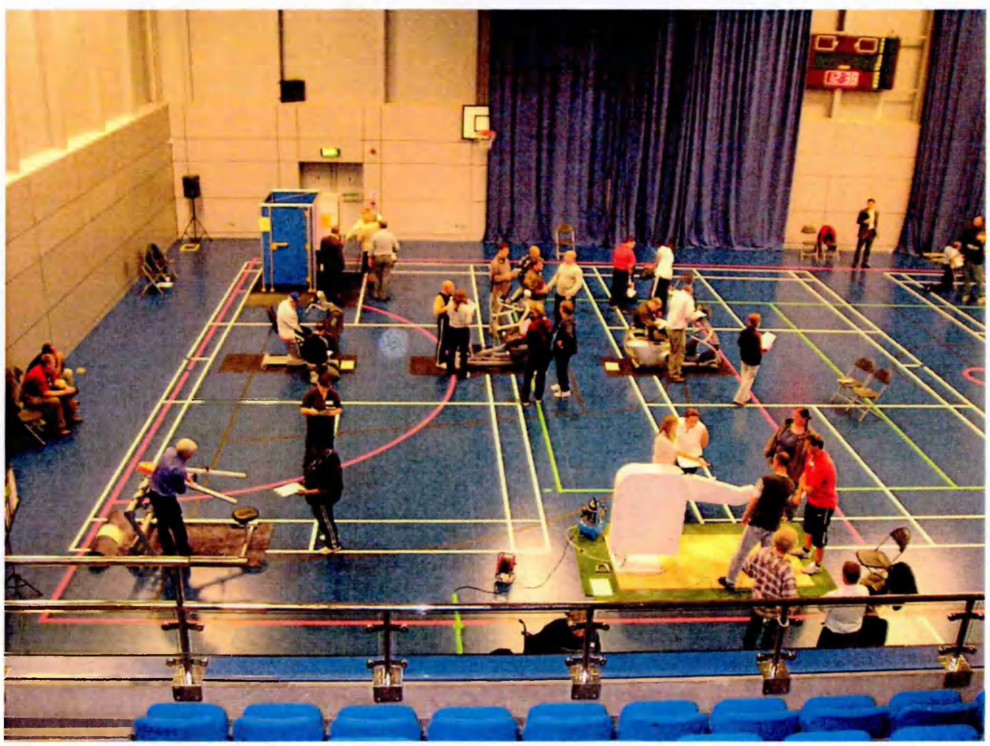


Figure 4.1: Simulated gym environment for practical product testing at the English Institute for Sport, Sheffield

4.2.2 Profile of Equipment Tested

Testing was performed on 209 separate pieces of fitness equipment, supplied in total by 33 different manufacturers (see Appendix B for full list of equipment suppliers). All products were either commercially available, or prototypes intended for development into commercial products, ensuring any data collected was relevant and up-to-date. To ensure a broad variety of equipment types, selection of equipment was made through consultation with numerous fitness equipment supplier organisations operating in the UK marketplace, who were invited to submit products they considered had features suitable for inclusive use (see Appendix C). For testing purposes the remit of what constituted 'fitness equipment' was defined in accordance with the safety standard for these product types, BS EN 957-1:

> *"Equipment that is not moved as a unit during use, and which either stands on the floor or is attached to a wall, ceiling or other fixed structure. Training equipment can be used for the following:*
>
> *(a) physical culture, body building or body styling;*
> *(b) health fitness training;*
> *(c) physical education; and*
> *(d) training specific to competition and related sports activities."*

(BSI, 1997a, pg 3)

Each product was assigned a 'generic product type' classification from the following list, which mirrors the delineations and definitions contained within the relevant Parts of the BS EN 957 safety standard (BSI, 1997a). Allocation of a product into a particular subcategory was based on equipment name, previous knowledge of similar products, pictorial or descriptive information available in relevant sales literature or through direct consultation with supplier representatives.

Generic product type categories:

- Treadmill
- Upright cycle
- Recumbent cycle
- Upper body ergometer
- Stepper
- Elliptical trainer
- Rowing machine
- Upper body resistance
- Lower body resistance
- Multistation
- Miscellaneous
- Access aid

A cross section of generic product types was represented over the 5 practical test sessions, with a total of 30 to 45 items under investigation at each event. Table 4.1 shows a breakdown of the 209 products tested in total by generic product type, highlighting the diversity of items studied. The equipment types with higher numbers tested represent the broadest categories which encompassed the greatest range of products. The complete data set includes upper, lower and total body exercise options for both cardiovascular and strength training. This product profile offered a full body workout for the majority of users, which would consequently be reflected in the scope of the resulting inclusive design standard.

All products were delivered and set up at the testing venues by supplier representatives. Personnel from each supplier organisation accompanied products during testing to comply with product liability insurance requirements and to provide practical demonstrations to testers where necessary. Supplier representatives were briefed to act in a supervisory capacity only, unless instructing on safe exercise procedures, to ensure that testers were able to use and consider the equipment unhindered.

Table 4.1: Products tested by generic product type

Generic Product Type	Number Tested
Treadmill	21
Lower Body Resistance	38
Upper Body Resistance	58
Multi-Station	26
Upright cycle	12
Recumbent cycle	15
Elliptical Trainer	7
Access Aids	8
Stepper	4
Miscellaneous	10
Rowing machine	3
Upper Body Ergometer	7
Total	**209**

4.2.3 Profile of Tester Population

The overall data set compiles opinions from 122 individual volunteer testers. Tester recruitment was carried out in conjunction with the IFI, in order to utilise their extensive network of contacts, and took a targeted pan-disability approach, using self-declaration of impairment(s), with a clear focus on disability as opposed to aging. Individuals declared their impairment(s) by selecting the appropriate option(s) from the short predefined list shown in Figure 4.2, which was originally set out by the IFI in order to monitor facility usage by disabled people. A stratified sampling method was employed by the author in order to ensure consideration of a cross section of different impairment types. This broadly representative, albeit non-statistical, sample of the disabled population was chosen with the assistance of IFI personnel using purposive and convenience approaches, to give a test group who were able to provide relevant data and who would be able to attend sessions as needed. Contact was made through local disability groups and publicised via word of mouth to recruit testers from the general public. Testers identifying as non-disabled were also in attendance during all test sessions to ensure feedback would reflect an inclusive approach. As the foundation of the design standard, tester feedback would therefore ensure transposition into a standard to support inclusive design, rather than just design for disability.

Please indicate in the box any impairment that you have:			
Amputee – Lower limb	❑	Multiple Sclerosis	❑
Amputee – Upper limb	❑	None	❑
Cerebral Palsy	❑	Paraplegic	❑
Dwarfism	❑	Stroke	❑
Hearing Impaired / Deaf	❑	Visually Impaired / Blind	❑
Learning Disability	❑	Other (please state):	❑
Mental Health	❑	....	

Figure 4.2: Tester self-disclosure list of impairment(s)

Figure 4.3 shows a breakdown of the total number of testers by impairment classification, demonstrating coverage of the major functional divisions of physical (43%), sensory (16%) and cognitive (22%) impairments. Testers identifying with two or more categories from the predefined impairment list were designated under a 'multiple impairment' category (7%). It is noted that whilst the majority of testers identified with a single condition, many of these will also display associated secondary impairments, for example multiple sclerosis causing reduced vision, or learning disability being associated with reduced range of movement and co-ordination in some instances. It is likely that these testers were able to give feedback across the different impairment categories. Those with conditions manifesting high-risk scenarios, for example acute coronary heart disease, were not included as individuals displaying such symptoms would need to be under direct medical and rehabilitative supervision. Although not formally recorded, congenital and acquired disabilities were represented alongside a continuum of impairment severities. An age range of 16 – 86 years was covered with 59% male and 41% female testers.

Experienced and non-gym users were recruited to ensure a variety of previous expertise of the gym environment and fitness equipment usage.

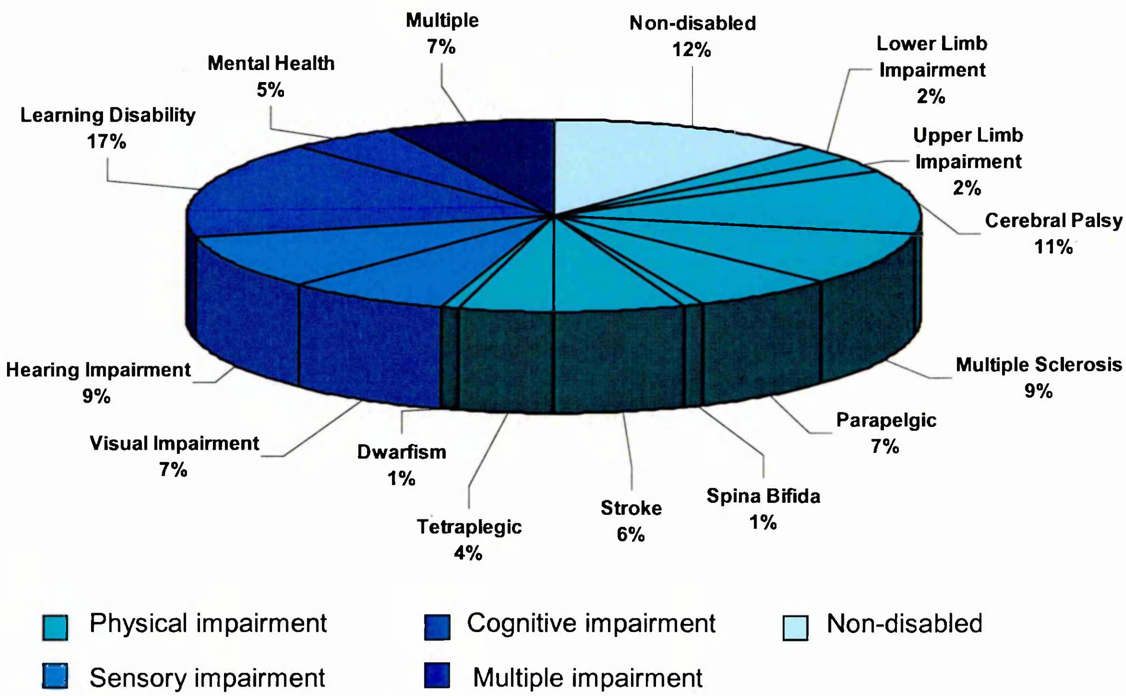


Figure 4.3: Total number of testers by impairment classification

At each of the 5 practical testing sessions, there were 30 – 40 testers present to facilitate data collection from multiple users on all products. With each tester having attended 0 – 4 of the previous sessions, this also provided for a range of novice and experienced attendees. Every test session commenced with a briefing for testers, personal assistants/carers and buddies, which clearly disclosed the purpose of the study and the organisation that commissioned it. Detailed requirements and expectations for the day were discussed and testers were assured of their rights to confidentiality and anonymity during data collection, analysis and subsequent dissemination of findings. All participants gave their written informed consent to be involved in the study.

4.2.4 Questionnaire Design

Data was collected through a questionnaire developed from that originally proposed to the IFI by Suresh Paul and Spencer Holmes, experts in inclusive design and inclusive fitness instruction respectively and subsequent members of the equipment expert panel discussed in Chapter Six. These authors utilised practitioner-based observations and inductive reasoning to create the foundation for their original questionnaire, identifying a model with seven usability criteria to form the basis of their survey questions. The criteria identified were: ease of access into/onto equipment, ease of access out of/off equipment, adjustability, range of movement, range of resistance, ease of use/programming and comfort. To elicit a quantitative data set, a six point (0-5) scoring scale was applied where '0' represents user dissatisfaction through to '5' which represents a high level of user satisfaction. Open-ended qualitative feedback was also gathered to clarify user satisfaction scores measured through the closed questioning of the quantitative data. The resulting tester scoring sheet is shown in Figure 4.4. Prior to testing all users were given an additional sheet which explained the terms used and defined each 0-5 point scoring criteria (see Appendix D).

CATEGORY	SCORE					
Ease of access into / onto	0	1	2	3	4	5
Ease of access out of / off from	0	1	2	3	4	5
Range of movement	0	1	2	3	4	5
Range of resistance	0	1	2	3	4	5
Adjustability	0	1	2	3	4	5
Comfort	0	1	2	3	4	5
Ease of use / programming	0	1	2	3	4	5

Other Specific Comments

Figure 4.4: User feedback questionnaire (original version)

As a direct result of data analysis from the first two test sessions the questionnaire was developed further by the current author. Space for open-ended comments was allocated after every question to encourage more qualitative feedback and to offer increased scope for users to answer more fully. This change also facilitated direct association of any issues with the specific criterion concerned. The development of a separate questionnaire for each generic product type, alongside simple prompts concerning relevant product components further enhanced data collection. An example of a complete product-specific questionnaire is shown in Figure 4.5 for the treadmill category. The decision was taken to encourage tester feedback more directly towards product-specific features to ensure that an increased number of components were considered, thus giving the data required to provide a more comprehensive inclusive design standard. Ensuring that the questionnaire tested the product features and not the capabilities of individual testers had important implications for question wording, for example 'how easy to start exercising' was used rather than 'can you start exercising' as shown in the ease of programming question in Figure 4.5. To increase the accessibility of the data collection medium, 'smiley face' pictograms were added to represent the satisfaction continuum alongside the numeric scale. Mencap (2000) suggest that this technique may be particularly beneficial for those with cognitive or learning impairments, or those who naturally relate more easily to visual information. A further amendment was the addition of a 'not applicable' option to the quantitative scale. These changes were verified through trial runs with 9 testers prior to the main testing sessions.

Questionnaires were self-administered during each test session, allowing a large sample size cross-sectional study to be achieved. Testers completed a separate questionnaire for each piece of equipment tested. Score sheets and feedback mechanisms were adapted where necessary to ensure users' views were recorded regardless of impairment, for example questionnaires were provided in large print and sign language interpreters, scribes and buddies were available to assist with completion of documentation. Testers were encouraged to spend as much time with each product as they deemed necessary to become familiar with its usage and to complete their evaluation questionnaire to their own personal satisfaction. Figure 4.6 shows a compilation of images taken during the test sessions, showing a cross-section of testers completing the practical testing and questionnaire feedback, and examples of completed questionnaires are given in Appendix D.

inclusive fitness

Inclusive Fitness Initiative
Treadmills

Tester Number

Equipment Piece Number 10

Please score the following according to the scoring criteria:

CATEGORY **SCORE**

Ease of access on / off N/A 0 1 2 3 4 5

☹ ☹ ☹ 😐 ☺ ☺

Ease of programming N/A 0 1 2 3 4 5

☹ ☹ ☹ 😐 ☺ ☺

(e.g. how easy to start exercising, how easy to know how far through the program you are, how easy to change speed, size of writing on console, colours used, tactile information)

Turn over page

Figure 4.5: User feedback questionnaire (product-specific version - Treadmills) Page 1

(Figure continued overleaf)

Range of speed N/A 0 1 2 3 4 5

(e.g. minimum / starting speed, increments in speed)

Use of emergency stop N/A 0 1 2 3 4 5

(e.g. position of emergency stop button, ease of use)

General comfort N/A 0 1 2 3 4 5

(e.g. position and size of handles, smoothness of machine)

Other comments, problems or suggestions

Figure 4.5 (cont.): User feedback questionnaire (product-specific version - Treadmills) Page 2

Figure 4.6: Testers performing practical tests of equipment

(Figure continued overleaf)

Figure 4.6 (cont.): Testers performing practical tests of equipment

4.3 Quantitative Data Analysis

Subsequent to completion of the five practical testing sessions by disabled users, the quantitative data was collated from the questionnaire responses to enable data analysis and identification of relevant findings in order to inform the development of the inclusive design standard.

4.3.1 Data Analysis Methods

Tester quantitative scores (0-5) for each of the seven usability criteria were recorded on an aggregated spreadsheet (Microsoft Excel) post-event for all equipment items tested. Data was grouped according to the generic product type category previously assigned. Within each generic product type, tester data was grouped by self-declared impairment to allow easier identification and comparison of impairment-specific trends. All further analysis was performed within the generic product type classifications, ensuring generation of design knowledge which would translate more easily into a product-specific inclusive design standard.

Initial consideration was focused towards identifying an overall level of design exclusion for each generic product type. Consideration of relative levels of exclusion would highlight any particularly problematic products, consequently indicating those requiring the most immediate inclusive design attention. Average tester scores were calculated for each individual piece of equipment tested. An average of these individual equipment scores was then taken across each generic product type, to give an overall average score.

With an outline of the most and least accessible generic product types established, enquiry turned towards identifying variability within scoring for each of the seven defined usability criteria. This endeavour aimed to analyse and compare the broad functional areas of product usage covered by the usability criteria. Assessing those areas which offered significant, or indeed insignificant, barriers to access would again guide the content and focus of the inclusive design standard. Average tester scores were calculated for the seven usability criteria for each individual piece of equipment tested. An average of these usability scores was then taken across each generic product type, to obtain overall average scores for each of the seven usability criteria on a generic product type basis.

4.3.2 Results

The rank ordered overall average scores, for each generic product type, are presented in Figure 4.7 to identify relative levels of user satisfaction, and by inference design exclusion. High numeric scores indicate high user satisfaction and therefore represent the most accessible generic product types, according to the tester feedback provided. Conversely, low numeric scores suggest the presence of design exclusion, and hence decreasing accessibility of product types is apparent moving from top to bottom in Figure 4.7.

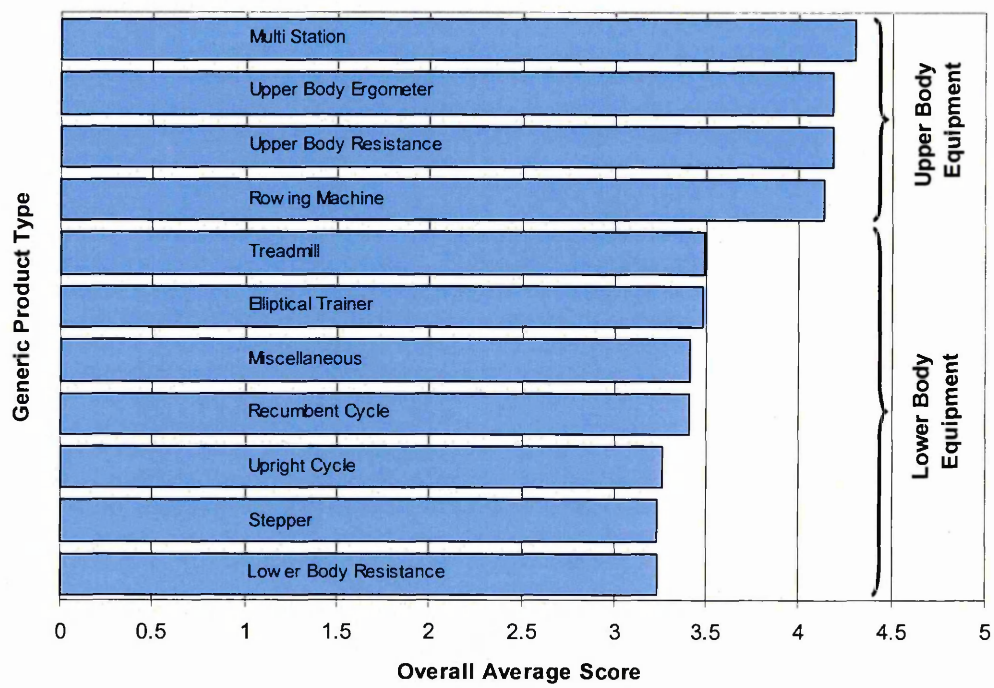


Figure 4.7: Rank ordered overall average score data indicating most to least accessible generic product types

The overall average scores for each usability criteria, across all generic product types, are presented graphically in Figures 4.8 to 4.11. As in Figure 4.7, high numeric scores correlate with higher levels of user satisfaction and decreased design exclusion. Accessibility, by usability criteria, is therefore maximised towards the upper limit of each of the vertical scales in Figures 4.8 to 4.11.

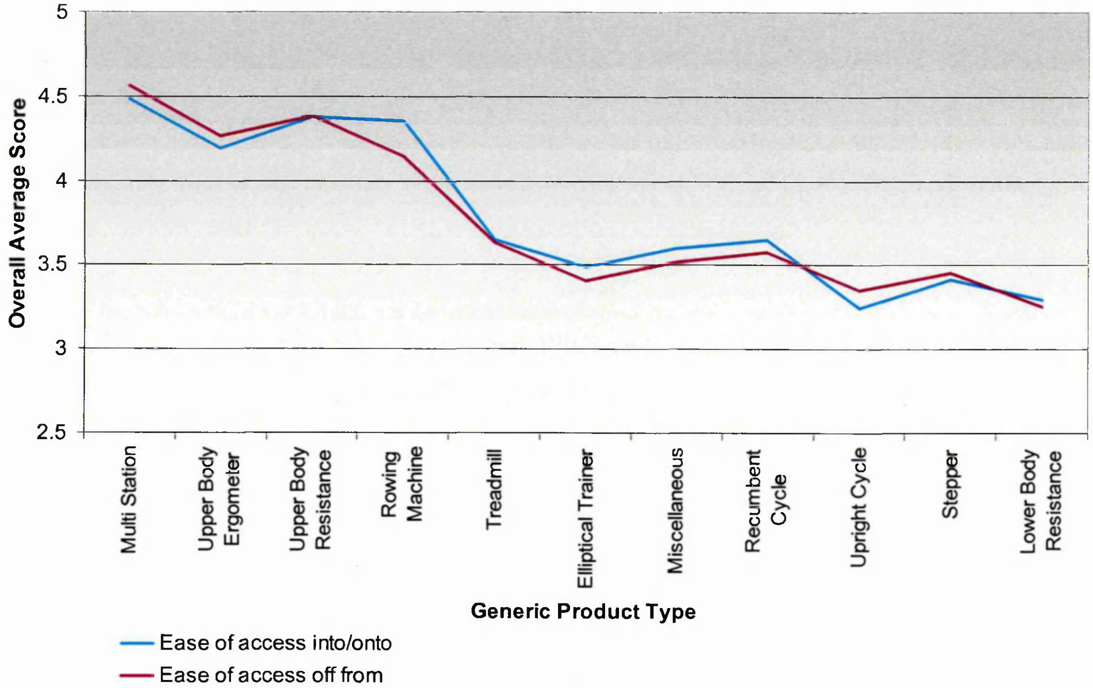


Figure 4.8: Overall average scores for access and egress usability criteria

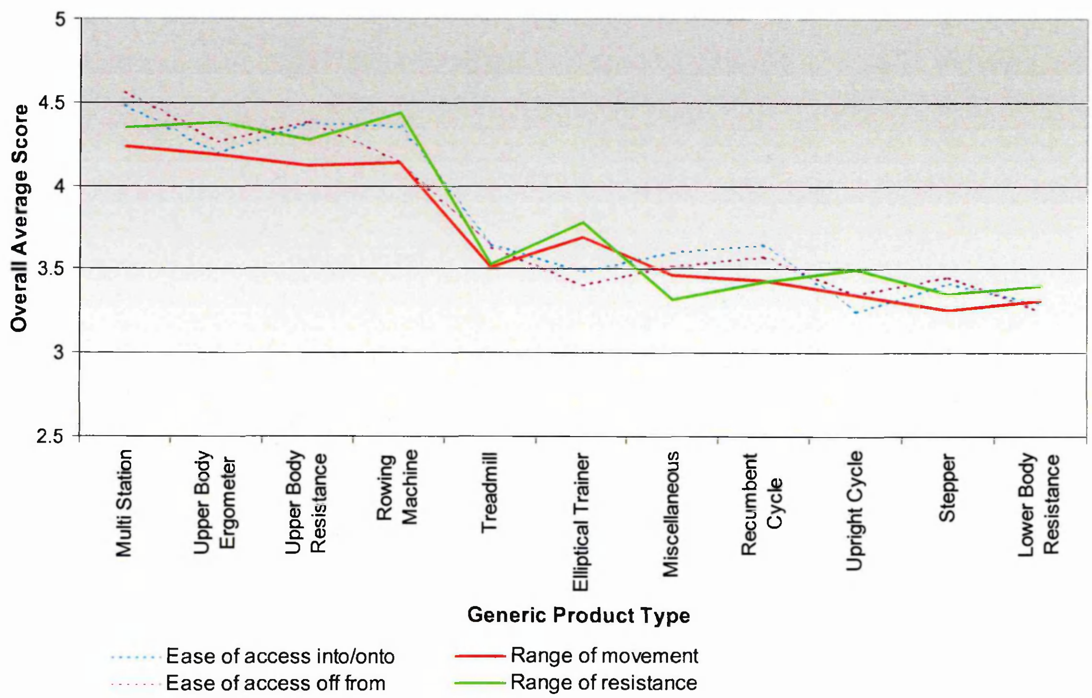


Figure 4.9: Overall average scores for range of movement and range of resistance usability criteria

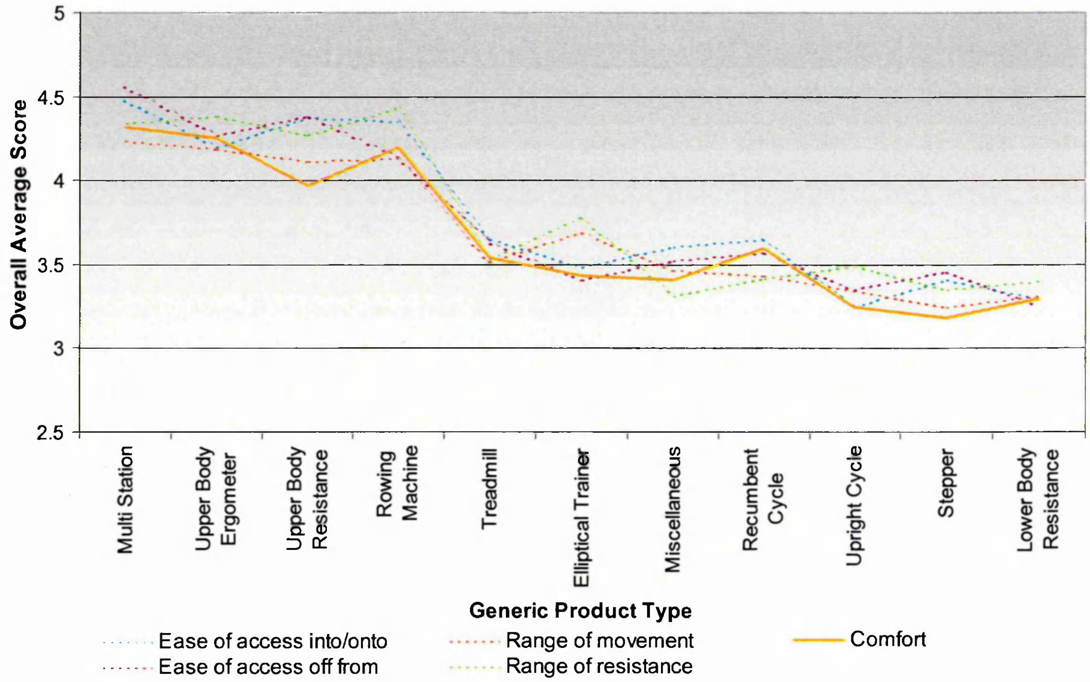


Figure 4.10: Overall average scores for comfort usability criteria

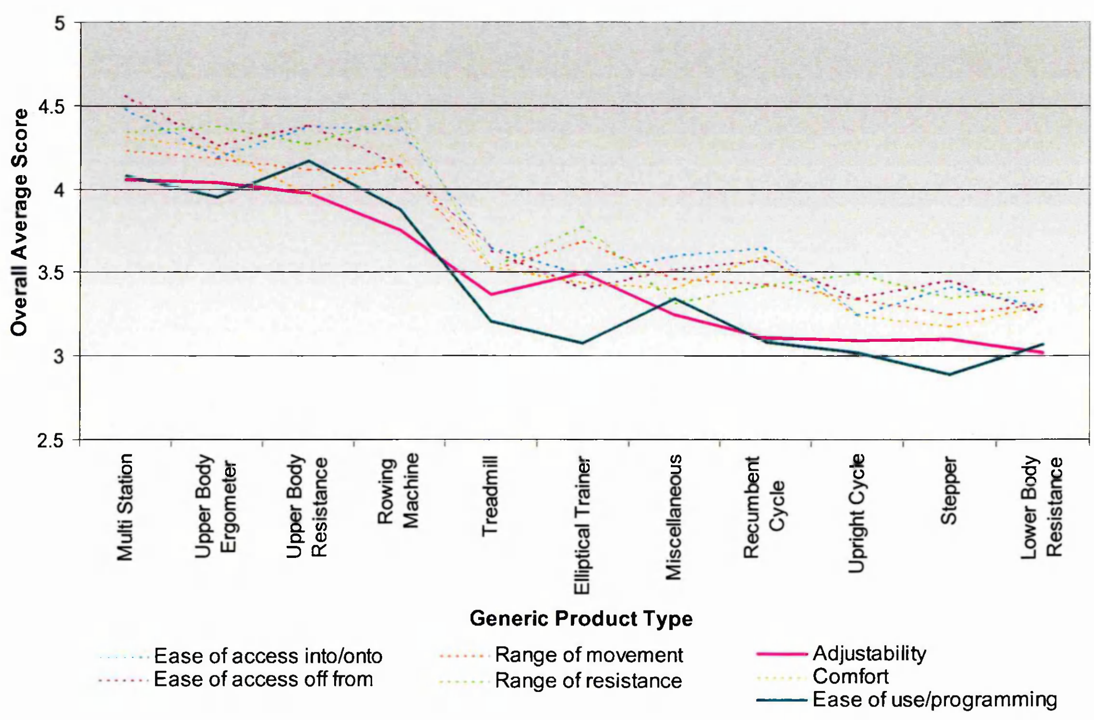


Figure 4.11: Overall average scores for adjustability and ease of programming usability criteria

4.3.3 Discussion of Findings

Rank ordering the overall average scores across all generic product types, as in Figure 4.7, allowed a comparative analysis of user satisfaction with current equipment design. The observed trend was for upper body equipment to score more highly, and hence be considered generally more accessible, than lower body equipment. This result replicated findings from the literature review in Chapter Two, which suggested that an over concentration on lower limb exercise, notably in cardiovascular equipment, was problematic for many disabled users (Ward *et al.*, 2001). One factor likely to be influencing this phenomenon is the relatively high prevalence of mobility impairments within the disabled population, meaning that those with reduced leg function are immediately excluded from much current mainstream equipment. The importance of these results was reflected in the considerations for the development of the inclusive design standard:

- to ensure that a wide product range was addressed within the standard in order to provide equipment choices appropriate for users with a range of functional abilities
- to increase accessibility of lower body products was of paramount concern
- to ensure that accessibility requirements for upper body products were not neglected as they may offer the only viable exercise options for users without lower limb function.

Together with the varying accessibility across generic product types, apparent in Figure 4.7, it is clear from Figures 4.8 to 4.11 that there is also variability in the usability criteria scores within each product type. The deduction was made from this non-uniform scoring distribution that unique aspects of design are problematic for different product types. This corroborated the need to adopt a research approach which considered user feedback with respect to different product types and did not treat the data set merely as a single collective whole.

Graphical representation of the overall average scores demonstrates noticeable trends when comparing individual usability criteria across generic product types. Figure 4.8 directly compares the usability criteria of equipment access and egress. These criteria display comparable results, which is unsurprising since they represent somewhat analogous physical actions in terms of equipment usage, placing similar functional and cognitive demands on the user. Also demonstrating comparable trends are the usability criteria of range of movement and range of resistance, as presented in Figure 4.9. Uncertainty on the part of testers concerning the subtle differences between these category definitions, particularly identification of which specific equipment components were ascribed to each criterion, may account for some of the similarities apparent in these results. Figure 4.10 graphs the criteria of comfort, arguably the most subjective usability criterion assessed. Testers had a propensity to notice only extremes within this criterion i.e. very comfortable or very uncomfortable, and hence the trend line sits average amongst the other usability criteria assessed. Of particular interest however, are the criteria of adjustability and ease of use/programming, which are depicted in Figure 4.11. Whilst illustrating comparable trends to each other, both also score poorly and sit well below the other criteria investigated, indicating that these are the least accessible criteria across most current fitness equipment design. The criterion of adjustability can perhaps be most closely associated with resistance equipment usage, whilst ease of use/programming relates more directly to cardiovascular products. The results shown in Figure 4.11 reflect this assessment, showing that ease of adjustability scores were lowest for upper body, lower body and multistation resistance equipment, whilst ease of use/programming received the lowest score for six out of seven of the remaining cardiovascular products. Both criteria represent the act of product set-up and configuration, which is fundamental to the successful, effective and safe use of any fitness equipment. The general trends observed for these criteria suggest a widespread and recurring problem in these aspects of design. Improvements in these specific areas therefore offered the greatest potential for increasing product accessibility, and were used as a focus for the requirements set out in the inclusive design standard. The specific high to low ordering of usability scores within each generic product type additionally indicated the most significant sources of design exclusion within each equipment category, and guided the prioritisation of those areas requiring most inclusive design attention. Overall these findings were important for the development of the inclusive design standard as they reinforced the principle that distinctive and unique issues affect differing product types, thus signifying the need for a product-specific design standard. The identification of adjustability and ease of use/programming as significant issues affecting the accessibility of all product types was also particularly informative in focusing the exact requirements and scope of the final standards documentation.

4.4 Qualitative Data Analysis

Subsequent to completion of the five practical testing sessions by disabled users, the qualitative data was collated from the questionnaire responses to enable data analysis and identification of relevant findings in order to inform the development of the inclusive design standard.

4.4.1 Data Analysis Methods

Qualitative comments were tabulated post-event in a Microsoft Word document which collated data for all equipment items from all testers. Text was input verbatim, with only an extremely small quantity of data lost through indecipherable handwriting. Individual comments were tagged with the impairment category of the tester responsible for that specific feedback. Data was grouped according to the generic product type previously assigned, for further examination through a structured content analysis. Data analysis focused on a search for consistencies to identify critical and recurring issues common across a number of testers. These areas, which identified barriers to equipment use or examples of good practice, were subsequently used to form the base manuscript for the inclusive design standard.

Data was analysed using the process of qualitative categorisation, as described by Strauss and Corbin (1990). This technique involved a line-by-line analysis to assign a code to each qualitative statement of data. Unique codes were created for each of the seven defined usability criteria and additional codes and code descriptions formulated as required. Incomplete or ambiguous statements were coded as unusable data. Consecutive phrases were compared to determine whether they should be classified separately or whether they belonged to an existing code (Wolcott, 2001). Code allocation was a subjective exercise based on the author's opinion and interpretation of the meaning of the data, along with a detailed working knowledge of fitness equipment features.

The fully coded data set was sorted by code within each generic product type. Highlen and Finley (1996) describe this process of grouping responses into broad categories and then organising them into subcategories as a standard method for isolating emerging thematic statements. An additional advantage of considering the data contained within each generic product type, was elicitation of product-specific knowledge which would translate more easily into the inclusive design standard. To synthesise the tester comments into these specific meaningful themes, a content analysis was conducted on each coded generic product type data set. This inductive process judged each comment as either supporting or refuting an emerging theme or pattern. Those themes attracting multiple and recurring comments were noted and collated for each generic product type. Individual comments which did not extend throughout the data set but were deemed as revealing significant health and safety risks were also recorded.

4.4.2 Results

The following raw data illustrates typical tester feedback, with examples selected from a range of different generic product types and tester impairment categories:

"Seat high - adjustment required"

(Equipment - Leg Extension: Impairment - Cerebral Palsy)

"With a battery wheelchair, the wheelchair prevented me getting far enough back"

(Equipment - Pec Deck: Impairment - Muscular Dystrophy)

"Hip-knee length too long for my short legs so back rest needs to be able to be adjusted further forward"

(Equipment - Leg Extension: Impairment - Visual Impairment)

"All the adjustments are right hand and I found difficult to operate"

(Equipment - Leg Curl: Impairment - Upper Limb Impairment)

"Adjusting knobs a little confusing as they look as if you should twist them when they are actually a pull lever"

(Equipment - Leg Extension: Impairment - Deaf/Blind)

"Wrap it up. I'll take it home!"

(Equipment - Lower Back Extension: Impairment - Blind)

"Electrics confusing"

(Equipment - Elliptical Trainer: Impairment - Multiple Sclerosis)

"Due to size of fonts it is difficult to access programmes"

(Equipment – Treadmill: Impairment - Visual Impairment)

"Need flash to let me know time is up because it has sound and I cannot hear it"

(Equipment - Upper Body Ergometer: Impairment - Hearing Impairment)

"Machine kept cutting out on weak leg not registering"

(Equipment - Recumbent Cycle: Impairment - Multiple Sclerosis)

"Seat didn't adjust low enough for me to get on and off easily"

(Equipment - Upright Cycle: Impairment - Non-disabled)

"Too big I could not reach the handle"

(Equipment - Elliptical Trainer: Impairment - Learning Disability)

As a consequence of the coding and thematic analysis procedure, the major themes extracted from the raw data were collated for each generic product type. A complete summary of the foremost themes evidenced by the testers, presented by generic product type, is provided in Appendix E. An extract of this information is replicated below in Table 4.2 for upper body resistance equipment and in Table 4.3 for recumbent cycles as an exemplar of findings. These unfiltered data sets represented the first draft of the inclusive design standard's content.

Table 4.2: Results of qualitative thematic analysis – main findings for upper body resistance equipment

Topic	Specific Theme
Access and Transferring	Equipment unusable if unable to transfer/remove seat
	Difficulty removing seat
	Lack of handles to assist transfer
Adjustment Mechanisms	Adjustments too heavy to use
	Stiff adjustments
	Poorly positioned or difficult to reach
	Fiddly, awkward or hard to grip
Positioning for Exercise	Handgrip positions need redesigning
	Handgrips need to be more adjustable
	Difficulty reaching high handles - can't use grab handle at higher weights, assistance required
	Difficult to achieve correct exercising position with wheelchair access (arms too far back, excessive stress placed on shoulder joint)
Range of Resistance	Weights too heavy
	Increments too large
	Use of half weights desirable
Seating and Stability	Sliding off seat when pushing
	Seat too small
	Seat too hard/uncomfortable
	Feel unstable/unsafe when exercising due to lack of trunk support (open sided machines)
	Need for seatbelt and/or back support
Asymmetry	Difficult to use unilaterally - grip particularly difficult
	Unequal strength
Sensory Information	Need for tactile information - especially on weight stack
	Better use of colour contrast required
	Utilisation of colour coding (specifically on pads, handles, seats, adjustments, weight pins, frame, and upholstery)
Instructional Advice	Poor instructions provided
	Instructions absent or incomplete
	Poorly positioned
	Use of diagrams required
	Inappropriate vocabulary

Table 4.3: Results of qualitative thematic analysis – main findings for recumbent cycles

Topic	Specific Theme
Access and Transferring	Step over too high, good range of movement needed
Adjustment Mechanisms	Getting feet into pedals and foot straps difficult
	Fastening/adjusting pedals and foot straps problematic
	Seat adjustment hidden or difficult to find
	Seat adjustment hard, difficult or fiddly to use
Positioning for Exercise	Foot unintentionally contacting with central section of frame or falling out of pedals (heel strap required)
Sensory Information	Pedals and foot straps need better colour contrast
Instructional Advice	Complicated equipment - instruction or assistance required
	Console is complex/too much information
	Console text too small
	Better colour contrast required on console information
	No audio feedback provided
	Tactile information required

4.4.3 Discussion of Findings

The amalgamation of all results from the qualitative thematic analysis into a single document, whilst retaining the product-specific nature of the information, provided a first draft of the inclusive design standard. Consideration of this complete data set was able to highlight consistent and also unique trends across all generic product types. The most commonly recurring themes could be categorised under the following broad headings:

- Need for clear and easy access onto equipment
- Adjustment mechanisms currently difficult to use
- Unsuitable resistance increments and ranges of movement
- Overly complex programming
- Lack of multi-sensory information on user-product interfaces.

The dominant themes identified above support results from the quantitative data analysis, as described in section 4.3, where adjustability and ease of use/programming criteria scored poorly compared with other areas. Additionally, these findings further support the content of the literature review presented in Chapter Two. Many of the specific barriers to access reported by other authors were explicitly noted by the current tester group and can also be categorised under the broad headings defined above. Identification of these key themes was intended to ensure that they were an explicit priority within the development of the standard.

With an initial outline of the inclusive design standard's content now established within a single document, this provided a tangible and central resource from which the full standard could be developed. This detailed manuscript was utilised to instigate discussions with other stakeholders involved in the equipment design process to ensure the practicality of any written standard. For each generic product type, the script comprehensively identified specific areas of design exclusion alongside those features providing good accessibility from the perspective of a wide range of disabled testers. Specifically, the document was able to highlight the key areas for discussion with commercial equipment supplier representatives, as described in Chapter Five, and also representatives from the health and fitness professionals stakeholder group, as described in Chapter Six.

4.5 Conclusion

This chapter has described the test protocol, data analysis and findings resulting from a series of practical testing sessions carried out to elicit information on the accessibility of existing fitness products. A sizeable sample of disabled individuals was used to collect qualitative and quantitative data via questionnaire, draw conclusions and make recommendations on inclusive fitness equipment design relevant to the wider population of disabled people. With existing literature unable to provide sufficient technical detail for fitness equipment supplier design staff, the aim of the study was to fulfil research objective (2) and assimilate comprehensive and reliable data concerning design exclusion over a wide range of impairment and product types.

Analysis of the quantitative data set revealed that although upper body equipment was considered generally more accessible than lower body equipment, low scores were seen across all generic product types. The implication of this finding was to indicate that the inclusive design standard should provide for a wide range of products rather than focussing on a single item. Quantitative data analysis additionally identified adjustability and ease of use/programming criteria as being particularly problematic for many disabled users, leading to these key areas being considered as a priority throughout the standard's development process. This outcome was reinforced by the results of coding and thematic analysis of the qualitative data set, which also led to the first unfiltered draft of content for the inclusive design standard. Representing entirely new knowledge for the fitness equipment industry, it was consequently necessary to consult with representatives from both the equipment supplier and health and fitness professionals stakeholder groups in order to further develop this initial draft and gain a wider consensus on the final content of the standard.

Chapter Five: Industrial Consultation on an Inclusive Design Standard

5.1 Introduction

User perspectives have been considered in Chapter Four, with the findings leading to the creation of an initial manuscript for the inclusive design standard. The research was now extended to other stakeholders, to ensure that the final inclusive design standard was written to meet the requirements of the equipment supplier design staff who would eventually be tasked with its implementation. Keates *et al.* (2000) conclude that in order to offer successful guidance concerning designing for a wider population, it is necessary to understand not only the requirements of the users of products, but also the users of design information. The present chapter hence addresses research objective (3) by examining barriers, opportunities and imperatives for the development of an inclusive design standard with a sample of fitness equipment supplier representatives, to identify their specific needs in realising a new design standard within the supply chain. These issues are explored through a series of focus group sessions attended predominantly by equipment supplier design staff, but also including some non-design related organisational representatives, from which conclusions are drawn to guide the content of the standard.

Over the consultation period, it was noted that the role of the various equipment supplier representatives evolved from one of generic discussion and advice to one of providing specific feedback on the content of the standard. The current chapter focuses on the former information, examining firstly the state of readiness of the industry to accept and respond to an inclusive design standard, and secondly the industrial context within which the implementation of the standard will occur. Explicit technical contributions to the standard, although gathered in part during focus group sessions, are described separately in Chapter Six for reasons of clarity.

5.2 Consultation Objectives

The worth and effectiveness of any standard will be maximised if is written in response to the needs of those who will use it (BSI, undated b). Ward (2005) believes industrial design teams are a remarkable asset to reshaping the future of fitness, and this is undeniably true within the context of the development of an inclusive design standard for their industry. Correspondingly, professional fitness equipment designers and senior managers responsible for commissioning design from within their organisations, were consulted to capture their experience, requirements and aspirations for the standard and its development process. Specific technical contributions to the standard were sought together with insights concerning individual, professional or organisational barriers to adoption. Findings would inform not only the standard's content but additionally the processes by which it would be disseminated and implemented within the industry.

In summary the consultation objectives were to:

- Explore the critical reasons which have led to the current situation of inaccessible equipment being widespread in the marketplace.

- Explore the specific perceptible and intangible barriers to adoption of inclusive design principles within the current fitness equipment industry, with particular regard to:

  (a) Identifying individual, design, managerial and organisational barriers
  (b) Confirming or refuting the apparent dearth of fitness industry-specific inclusive design information or product data
  (c) Establishing requirements to support change towards implementing more inclusive design practices.

- Verify the development of an inclusive design standard as a viable approach to facilitate equipment design to better encompass the needs of disabled people, and:

  (a) Establish support for and cooperation in the standard's development process
  (b) Provide a forum for a range of supplier representatives to voice concerns or imperatives concerning the standard
  (c) Elicit technical contributions and content for the standard
  (d) Recognise reasons for participation in the consultation and standard's development process.

5.3 Participating Suppliers

Fitness equipment supplier participation in the consultation process was achieved through response to an open invitation to the industry to become involved with the inclusive standard writing process. The invitation was made through both written and verbal correspondence in popular industry press and trade journals, attendance at industry trade events and direct targeting of major equipment manufacturers operating in the UK marketplace. The only conditions governing participation were that organisational representatives should be affiliated to a company involved in the design and supply of commercial fitness equipment, and that they displayed a commitment to working in partnership to develop an inclusive design standard. No qualifying organisation was turned away from the group and membership was held open for any company wishing to join after initial commencement of the study. A total of 15 equipment supplier organisations, identified in Figure 5.1, responded positively and actively participated in the consultation process. 13 supplier organisations were involved throughout the duration of the investigation, with 2 additional companies (indicated by *) joining subsequently.

Figure 5.1: Equipment supplier organisations participating in the consultation process

Due to a lack of publically available market share information, it is only possible to provide an indicative assessment of the breadth of the consultation process provided by this sample of 15 supplier organisations. This estimate should, however, be sufficient to highlight the diversity and broad market representation of the participating supplier group. AMA Research (2005) provide market share estimates for the ten leading suppliers within the fitness equipment supply sector which are thought to represent 77% of the total market, as shown in Table 5.1, which additionally denotes those supplier organisations involved in the consultation process. Six of the top ten companies participated in the consultation; including Life Fitness and Technogym who in combination dominate over 40% of the market and are hence considered to be the main market leaders.

Table 5.1: Market share estimates for key suppliers of commercial fitness equipment (2004)

Supplier	Market Share (%)
Life Fitness UK ***	27
Technogym UK ***	16
Pulse Fitness ***	8
The Nautilus Group UK ***	5
Cybex International ***	2.75
Precor Products ***	2.75
Market share for participating suppliers = 61.5%	
Star Trac UK	5
Concept 2	5
Physique	2.75
PowerSport International	2.75
Market share for non-participating suppliers = 15.5%	
TOTAL	**77% of market**

(***) = suppliers participating in the consultation process

Note: Equal division of reported 11% combined market share is assumed between Cybex International, Physique, PowerSport International and Precor Products

Source: AMA Research, 2005, pg 56

AMA Research (2005) offer no explicit information on the residual market of 23% not allocated within Table 5.1. This remaining market share is likely to consist chiefly of small and medium sized enterprises offering small ranges of traditional equipment, or single products for specialised or novel training areas such as vibration training platforms, Pilates equipment or spin bikes for group cycling classes. In addition to the 10 companies identified in Table 5.1, lists of the Fitness Industry Association (FIA) (2004) equipment supplier membership and Leisure Industry Week (LIW) (2005) exhibitors identify 38 companies offering commercial fitness products. This estimate excludes those selling refurbished gym equipment or providing purely supporting services such as maintenance or repair work. As First Research Inc. (2008) indicate that there are fewer than 100 manufacturers of fitness equipment operating in the United States, and the UK market is known to be considerably smaller than its American counterpart, the speculative estimate of around 38 different commercial suppliers competing for the remaining 23% market share is considered reasonable. The consultation process attracted 9 organisations from this group, equating to around 5.5% of the total market share, which in addition to the 61.5% of market leaders identified above, establishes the total breadth of this consultation at approximately 67% of the entire market, as Figure 5.2 represents. It is additionally estimated that 7% of the total market may not gain direct benefit from the development of the inclusive design standard, as these suppliers produce children's, outdoor or small equipment (such as hand weights and gym balls) which are not covered within the scope of the European safety standard (EN 957) or the intended scope of the inclusive design standard.

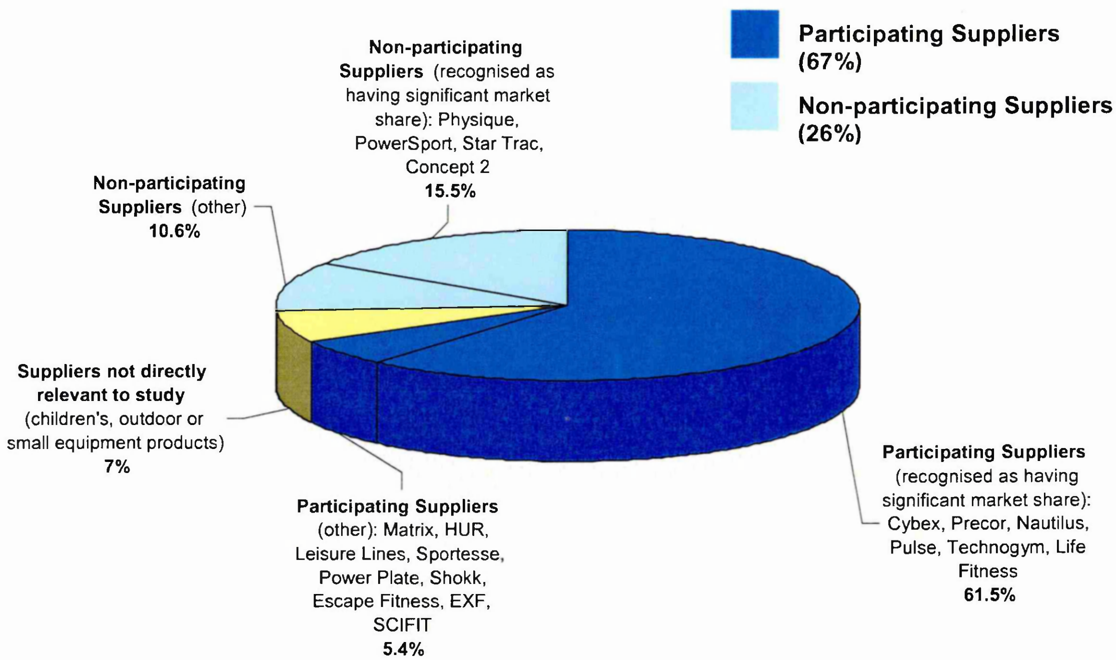


Figure 5.2: Breadth of consultation process, by estimated supplier % market share

Overall, this analysis shows that the supplier group recruited for the consultation process represents a majority in the industry and includes a diverse mix of organisational size and product range. This large sample size would afford the opportunity for wide consensus in development of the inclusive design standard, which was considered important for its subsequent recognition, acceptance and uptake. With the assembled supplier group being broadly representational of the actual UK market, findings from the consultation process should extrapolate with reasonable confidence across the remaining industry supplier population.

5.4 Research Methods

Following the detailed rationale provided in Chapter Three, ethnographic and observational research methods were employed to acquire information from a range of equipment supplier representatives. As ethnography is concerned with describing social groups or situations (McQueen and Knussen, 2002), this methodological approach lent itself well to investigating culture and attitudes towards disability, inclusion and standardisation within the equipment supplier community. Myers (1997) indicates that the qualitative research methods typically employed within ethnographic and observational techniques, are becoming more appropriate in industry as research tends towards managerial and organisational issues rather than purely technical ones. These investigative approaches were additionally deemed appropriate for data collection in the current research due to the exploratory, often intangible and complex nature of the topics under investigation. Accordingly, the focus group technique was selected as the principal research method to explore design exclusion and standardisation from a commercial perspective. Equipment supplier design staff were consulted and their wider organisations studied through a series of discussion-based forums as described below, supported by supplementary data collection though participant observation and other traditional qualitative inquiry methods.

5.4.1 Focus Group Data Collection

Rooted originally within the sphere of marketing, focus groups have evolved to become a popular instrument to assess attitudes towards new products, services, concepts or ideas (McQueen and Knussen, 2002). Questioning in an interactive group setting, usually under the guidance of a moderator or a facilitator, enables participants to talk freely with other group members. McQueen and Knussen (2002) believe therefore, that focus groups can provide researchers with background knowledge of an area and offer an excellent insight into the values, beliefs, fears and aspirations that comprise most attitudes. As an exploratory tool regarding new products, focus groups can be important for acquiring feedback before items are made available to the public, providing invaluable information about the potential market acceptance of the product (Marshall and Rossman, 1999). This characteristic was exploited with the fitness equipment supplier stakeholder group to assess not only tolerance for inclusive products in the marketplace, but additionally the potential commercial acceptance for an inclusive design standard. As a research method, focus groups allowed results to be elicited relatively quickly, often identifying unexpected issues for exploration and redress. Use of focus groups also increased the sample size of the study by involving several participants simultaneously, alongside the additional advantage of being low in cost (Marshall and Rossman, 1999).

Nine focus group studies were conducted in total, the dates and venue details of which are provided in Table 5.2 for reference, predominantly with equipment supplier design staff, but also including some non-design related organisational representatives. Figure 5.3 illustrates one of these events taking place. Seven sessions were held between March 2003 and December 2005, comprising the initial development phase of the inclusive design standard. It is the combined data from these sessions which forms the main basis for the findings presented in this chapter. Two follow-up focus groups, held in March 2008 and September 2008, were conducted post-publication of the standard to investigate its practical implementation within the industry. Feedback from these later studies is provided more extensively in Chapter Seven. Communication was maintained between focus group sessions via site visits and informal telephone and email conversations with the author.

Table 5.2: Focus group sessions - dates and venues

Session Number	Date	Venue
Standards Development:		
1	24th March 2003	Room 5511, Surrey Building City Campus, Sheffield Hallam University
2	28th October 2003	Room 7131, Stoddart Building City Campus, Sheffield Hallam University
3	21st January 2004	Room 3215, Eric Mensforth Building City Campus, Sheffield Hallam University
4	18th June 2004	Room 3104, Eric Mensforth Building City Campus, Sheffield Hallam University
5	8th December 2004	Seminar Room 1, English Institute of Sport Sheffield
6	13th October 2005	Room 7132, Stoddard Building City Campus, Sheffield Hallam University
7	5th December 2005	Room 2327, Harmer Building City Campus, Sheffield Hallam University
Post-Publication:		
8	13th March 2008	Chambers Suite, Staindrop Lodge Chapeltown, Sheffield
9	9th October 2008	Chambers Suite, Staindrop Lodge Chapeltown, Sheffield

Figure 5.3: Focus group session 6 attended by fitness equipment supplier representatives

Participant knowledge and expertise will dictate the quality of data collected, thus recruitment for focus group members was specifically targeted towards experienced members of the fitness equipment community. In total, 55 different individuals attended the sessions to convey their views on the development of an inclusive design standard, with attendee numbers ranging between 10 and 17 individuals at each focus group session. Of the total number of participants, 42 represented the 15 supplier organisations listed in Figure 5.1. Based on an analysis of job titles provided (including Product Designer, Industrial Designer, Head of Design, or Design Manager), half of these could be described as fitness equipment designers in the sense of being involved in the implementation or performance of product design tasks. The remainder of the non-design related organisational representatives reported their occupation to be one of the following:

- Managing Director or Chief Executive Officer
- Sales, Marketing or Brand Manager
- Business Development Manager or Director
- National or Group Account Manager
- Customer Service or Technical Support Manager.

The additional 13 attendees not directly affiliated to an equipment supplier organisation comprised 6 representatives from the IFI, 1 observer from the English Federation of Disability Sport and 2 university academics in the fields of sports equipment design and electronic engineering. The remaining 4 participants were invited experts from the British Standards Institution, YMCAfit, Equal Adventure Developments and Progress Training and Consultancy Ltd: offering expertise in product safety standards, fitness instruction, inclusive design and disability equity, respectively. This final group comprised of members from the 'equipment expert panel' utilised during subsequent phases of the standard's development process (see Chapter Six). Attendance by these individuals at a small number of focus group sessions allowed a firsthand appreciation of equipment supplier perspectives to be gained. The aim was to inform the panel's ensuing decision-making concerning the final content of the inclusive design standard.

Table 5.3 provides a numeric summary of focus group participants and profiles the organisations involved in order to illustrate the broad industrial representativeness of this commercial group. Up to a maximum of 3 representatives per supplier attended each focus group session, resulting in between 5 and 11 individual organisations, out of the total of 15 identified in Figure 5.1, being present at every event. From a market share perspective, of the 6 participating suppliers previously identified by AMA Research (2005) in Table 5.1 as having a significant presence in the market, an average of 4 were in attendance at each focus group session.

One fundamental difficulty with focus group studies is that the researcher has less control over a group compared to a one-on-one interview situation. Discussion is typically in reaction to the comments of other group members and thus data can be more difficult to analyse and time can be lost on issues irrelevant to the topic (Marshall and Rossman, 1999). To minimise this occurrence all fitness equipment supplier focus groups were run in a semi-formal meeting style, with clear discussion topics recognised through a predetermined agenda. Chairing was shared between the IFI National Director, who ensured that the agenda was followed and also provided information on the

IFI and the wider context of the research, and the author, who led discussion on specific topics. Data was recorded through meeting minutes, with supporting field notes also collected by the author. An example of a focus group agenda and minutes can be found in Appendix F.

Table 5.3: Focus group participants and profile of supplier representation

Session Number	Total Number of Participants	Number of Supplier Organisations Represented	Number of Major Market Share Suppliers Represented*
Standards Development:			
1	13	9	5
2	12	7	4
3	13	5	4
4	11	8	6
5	10	6	2
6	14	11	5
7	12	8	5
Post-Publication:			
8	17	7	4
9	12	7	4

* Major market share suppliers as identified by AMA Research (2005)

To ensure that a sufficiently qualified group of experienced fitness equipment designers were consulted, the agenda and any supporting documentation were provided to attendees prior to each focus group meeting. This enabled all representatives to consult with colleagues as appropriate for subsequent feedback during the sessions, which was particularly important to ensure the inclusion of non-UK based individuals within the study. Taking this approach and including non-design related supplier representatives in the focus group sessions enabled wider organisational barriers to achieving design changes, such as the difficulties in securing resources for design work against competing business priorities, to also be identified. All participants were encouraged to attend and observe the practical fitness equipment testing sessions, described in Chapter Four, ahead of focus group meetings. Interaction with disabled and non-disabled users was intended as an educational and awareness-raising exercise to inform and focus deliberations. A preparatory workshop was incorporated into the first meeting for those unable to partake in these practical test sessions, and to facilitate a critical reflection on their experiences for those who did attend. Working in groups of 3 or 4, each team was asked to consider generic products from the perspectives of individuals with a variety of physical, sensory and learning impairments in order to encourage exploration of the access challenges, in their opinion, of a range of current commercial fitness equipment items. Details of the issues raised are recorded in the meeting minutes which can be found in Appendix F. A concluding discussion involving all participants summarised the topics identified by individual groups, to give an increased appreciation of the potentially widespread inaccessibility of their industry's products. Specific examples of design exclusion were provided during the fourth focus group session, when a summary of the foremost themes evidenced by the testers for a range of generic product types, as provided in Appendix E, was presented. All focus groups were operated in an open discussion format, with questions posed following the scheduled agenda. The maintenance of free flowing discussion and inquiry was encouraged between group members, with further clarification and probing questions interjected by the author as deemed appropriate, to aid understanding or to avoid the discourse straying unreasonably off topic.

5.4.2 Supplementary Research Methods

Participant observation was utilised to further support investigation of inclusive design within the fitness industry, to capture anecdotal and supplier-sensitive information, both during and outside of focus group sessions. Communication was pursued with equipment supplier designer staff through informal interviews and discussions conducted during site visits to organisational headquarters, and also via telephone and email contact. Fitness industry press, advertising and published company documentation was also consulted and reviewed. The implementation of these additional research methods was necessary to overcome supplier concerns surrounding confidentiality during participation in a public forum at which direct competitors were present. The protection of intellectual property was paramount to assure candid and open discussion. Offering clear opportunities for interaction outside of focus group meetings allowed the author to act in an intermediary role which preserved the industrial insulation of competing organisations within the group. Subsequent dissemination of supplier-specific research information in generic formats allowed the independence of the author and confidentiality amongst organisations to be maintained. An additional benefit of engaging several research methods was in the capture of information which would otherwise be lost through reliance on a solitary approach.

5.4.3 Data Analysis

A content analysis was performed on data from the focus group meeting minutes and observational analysis to identify information relevant to the consultation objectives. Critical reflections by the author on site visits, industry literature, email and telephone discussions were also included, alongside a review of the experiential learning engendered through involvement with the supplier group to identify barriers, opportunities and imperatives for the development of an inclusive design standard. The results of this analysis would help to ensure that the final standard was written to meet the requirements of fitness equipment design teams and the organisations within which they work.

5.5 Research Findings

For clarity of reporting and ease of comprehension by the reader, the research findings, although often interrelated, are now presented within six distinct topic areas which relate to the consultation objectives set out at the beginning of the chapter.

5.5.1 Existence of Design Exclusion

Early consultations aimed to substantiate the existence of design exclusion in current commercial fitness equipment. Establishing a consensus on the existence of barriers to access for disabled people was deemed crucial prior to exploring the phenomenon and available avenues for change. Attendance at the practical fitness equipment testing sessions and the preparatory workshop session held during the first focus group provided explicit opinions on equipment accessibility. Table 5.4 summarises the main equipment components identified by supplier representatives as having potential accessibility shortcomings. The information contained within Table 5.4 is extracted directly from the meeting minutes of the first focus group workshop session which are provided in Appendix F.

Table 5.4 offers further evidence to that previously provided by disabled people of the widespread inaccessibility of existing fitness equipment. Interestingly, the perceived access barriers offered by the supplier group are not altogether dissimilar to those identified through the practical equipment testing by disabled users described in Chapter Four. The results are a small subset of the user requirements identified by this empirical testing approach. Supplier representatives revealed that attending the testing sessions was an effective means to outline required product developments in a non-threatening way, with increased ownership of the challenges provided after seeing them at first hand (Baker, 2006). A further reported observation was that several of the access issues identified were common both across impairment groups and across product types.

Table 5.4: Main equipment components identified by supplier representatives as having potential accessibility shortcomings (presented by generic impairment type)

<table>
<tr><th colspan="2">Fitness Equipment Supplier Consultation:
Potential sources of design exclusion for disabled people accessing current commercial fitness equipment</th></tr>
<tr><th>Physical Disability...</th><th>Visual Impairment...</th></tr>
<tr><td>• Most cardiovascular equipment focuses on the lower body
• Low starting speed
• Low step-up or step-over height
• Need to press buttons including the emergency stop
• Seats
• Grips
• Stability straps
• Unilateral movement
• Instructions - aimed towards disabled people? Pictorial
• Handles
• Adjustments
• Low start weights
• Pre-stretch mechanisms
• Space between equipment (turning circles, space for helpers)
• Assumption made by instructors about peoples abilities
• Disability training required - suppliers provide a training package/induction but generally do not include disability issues</td><td>• Product orientation and recognition
• Colour contrast - adjustments, flooring, walls
• Tactile
• No sharp edges, protruding pieces
• Ramps not steps
• Consoles - pattern to buttons, colour contrast, tactile
• Standardisation across range e.g. seat adjustment
• Panic button
• Clear space around equipment
• Training and induction
• Lighting
• Identification of weight selected
• Confusion with mixed weights e.g. lbs, kgs etc</td></tr>
<tr><th>Learning Difficulty...</th><th>Hearing Impairment...</th></tr>
<tr><td>• Obvious entry point to the machine
• Instructions and charts - pictures
• kgs, lbs etc - what do they mean?
• Easy set-up
• Distractions - noise, layout too busy, loud music
• Guided learning
• Number of commands before machine starts
• Reading and writing - console?
• Daunting environment</td><td>• Balanced affected therefore additional handrails
• Clear visuals needed to compensate for no audio feedback
• Auto shutdown for treadmill as cannot hear if moving
• Clear written instructions. Video? Sign language?
• Written induction material so can take away from session. Jargon?
• Demonstration important</td></tr>
</table>

Source: Fitness equipment supplier focus group consultation
Sheffield Hallam University, 24th March 2003

5.5.2 Current Perspectives on Inclusivity Within the Industry

Following agreement between focus group attendees on the presence of design exclusion, consultation moved on to examine the critical reasons which had contributed to this prevailing state of affairs. Two interconnected reasons emerged as paramount; a small perceived market size for 'disability equipment' and also a lack of practical information on designing for a wider consumer base. In combination, these factors have become a self-sustaining cycle of inaction towards provision of equipment for disabled people. The history of the industry, with its body building roots offering no innate link to people with impairments, provided a major rationale for the widespread deficiency in accessible fitness products. Supplier representatives described the situation where there is no expressed demand from clubs for equipment accessible to disabled people, resulting in the preconceived notion that there is no market for such products. Absence of these market pull forces, to which product designers often respond, has led to the assumption of a small market size and therefore little investment into the manufacture of accessible products. Without intervention, this paradoxical situation is unlikely to change as Bennett (1999) succinctly describes:

> *"People stay away from a club because the equipment isn't there, but the equipment isn't there because the people who need it stay away."*

(Bennett 1999, pg 32)

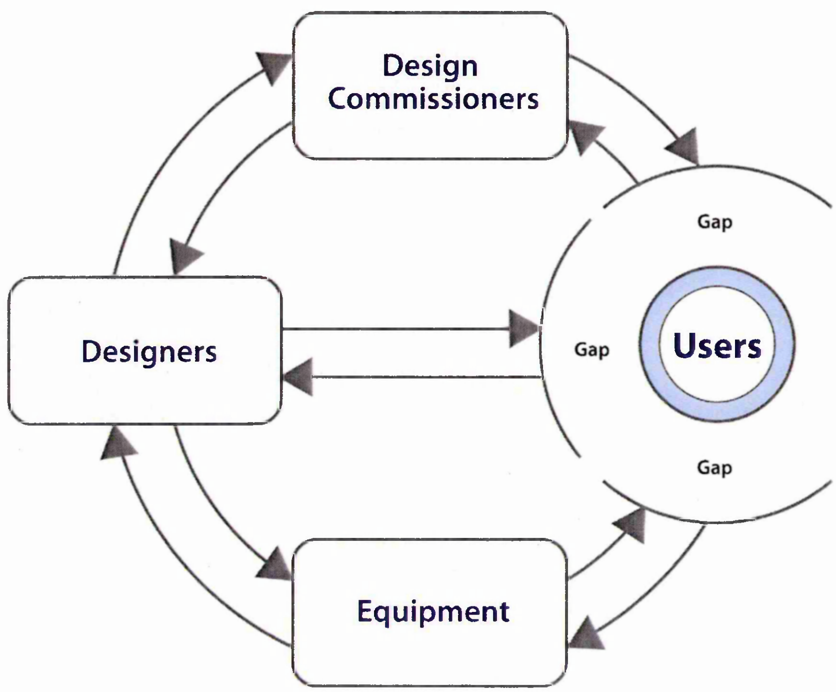
This finding highlighted the importance of the research in breaking the cycle of inactivity which had been created amongst the supplier group.

Organisations who had previously ventured into the disability marketplace reported one-off product ranges, accompanied by very small production runs, which were not deemed commercially viable or sustainable. In these instances, participants at the focus group identified that product design had been solely focussed on the needs of wheelchair users and that there had been minimal or no user consultation during the development process. Keates *et al.* (2000) have found that this form of stereotyping, which maintains the image of someone who is physically impaired as being a wheelchair user, to be a very common problem. This highly selective and focused form of provision is likely to have unwittingly contributed to the apparent lack of demand for accessible products reported by the supplier representatives. The widely held belief from the focus group attendees was that market size must be maximised for commercial viability and for the uptake of any inclusive design standard. Discussions around this topic indicated that in order to make a viable business case from the suppliers' perspective, it would be vital that the standard provided for the widest possible market whilst not excluding existing consumers, and that a range of impairments was considered to extend awareness beyond only wheelchair users.

5.5.3 Understanding of Inclusive Design

Focus group participants reported little awareness of inclusive design principles and practice within the existing commercial fitness equipment industry. The historic focus solely on provision for wheelchair users was indicative of this current level of disability knowledge. Supplier representatives recognised the presence of knowledge and communication gaps particularly, but not exclusively, between disabled users and product designers. Disabled people were rarely consulted concerning their needs during the design process or during strategic market planning by those commissioning design work. This situation is depicted in Figure 5.4 and is similar to the model reported by Keates and Clarkson (2003a).

When the principles of inclusive design were initially proffered to the supplier group, misconceptions about the nature of the topic were highly apparent. Misunderstandings between 'design for disability' and 'inclusive design' were in evidence, causing concern and anxiety amongst focus group participants about having to design and market products for "absolutely everybody" or "just for the disabled". Supplier representatives required reassurance that their current clientele would not be excluded from using inclusively designed products and also that compromises would have to be made between the needs of different disability groups requiring opposing features on products. Due to minimal previous contact with users with impairments, fears surrounding interacting with disabled people and appropriate terminology were also discussed at length. None of the equipment supplier design staff present at the focus group forums had experienced any formal training in inclusive design or similar disability-focused design methods, and were unaware of where to go to access appropriate information concerning the topic. This overriding deficit in inclusive design knowledge has serious implications for design education, design methodologies and industrial practice and offered an explanation for the current situation of inaccessible fitness equipment design. Development of a standard therefore provided potential opportunities for important awareness raising and education of product design staff in the positive tenets of inclusive design.



Source: Adapted from Keates and Clarkson, 2003a, pg 77-78

Figure 5.4: Knowledge and communication gap model for the fitness industry

5.5.4 Availability of Inclusive Design Information

A dearth of practical information on including the needs of disabled people in product design was cited as being significant in impeding the fitness industry's change towards more inclusive design practices. Directly quoting one focus group participant, a Design Manager for a large multinational equipment supplier:

> *"We are willing to make changes to our designs to make them more accessible, but we just don't know what changes are needed."*
>
> (Focus group participant, Session 3, 21st January 2004)

Collectively, focus group attendees were unable to give any explicit examples of fitness industry-specific inclusive design information. This concurred with literature review findings (detailed in Chapter Two) that there have been few, if any, other studies on this particular facet of the subject. Hence this research drew similar conclusions to those found by Voshol *et al.* (1997, pg 16), from their work involving design for elderly and disability populations that "the appetite for the market is bigger than its insight".

Dong *et al.* (2002) and Keates and Clarkson (2003a) deem information vital to the success of inclusive design. Although existing literature on inclusive design is considerable, its dispersion across different specialisms and tendency for confinement within academia was suggested as problematic during focus group feedback. It is consequently difficult for product designers to inform themselves adequately – which is not a situation unique to the fitness industry (see for example Clarkson *et al.*, 2000). Clarkson *et al.* (2000) describe a need for coherent and usable design guidance to enable product developers to access and take advantage of this important new disability market. Fitness equipment design staff representatives indicated that without such information being readily available, it is unlikely that they would have the inclination and resources to seek it out, or the confidence to act upon it. It was thus apparent that an unmistakable opportunity existed for research to provide new and useful design knowledge to the fitness equipment industry.

With fitness equipment design staff reporting they had insufficient time within the constraints of the design process to interact with users, their preferred solution was to call on consultancy services and utilise existing information. There was obvious anxiety from design teams surrounding the uptake of inclusive design practices, thus in order to alleviate this fear, user information would have to be presented in a familiar or non-threatening format. Product designers attending the focus group sessions were largely acquainted with the use of standards as a design tool. Their imperative was for this type of documentation to facilitate easy practical implementation of inclusive design theory and provide understanding of the needs of disabled people whilst avoiding information overload. Those focus group attendees who would ultimately be tasked with implementing the standard highlighted the need for cognisance of the corporate setting to be observed. Additionally, any successful standard would need to allow them freedom to focus on creative and resourceful problem solving, without the requirement for excessive supplementary research.

5.5.5 Challenges to Adopting an Inclusive Design Standard

With a general consensus reached that it would be of value to produce an inclusive standard specifically for the fitness equipment industry, the focus group were probed for impediments to adoption of such a standard. Unsurprisingly, early reactions to designing for a wider audience were analogous to those reported by researchers investigating other industries - development, testing and assessment expenditure, along with the tyranny of time to market and concern over final product price (Keates and Clarkson, 2003a). Without question the most recurring and dominant concern from all supplier representatives was cost. Competition in the fitness equipment industry is aggressive due to numerous competitors and product substitutes, with many supplier organisations having long term contractual agreements with gyms and therefore being limited to fixed prices and equipment specifications whilst under contract. Manufacturer margins have also been reduced due to the emergence and buying power of large fitness operator chains. All of these factors have led to limited funding for product development (Davies, 2004). Supplier representatives were therefore mindful of the financial implications of both development and subsequent implementation of an inclusive design standard. In their discussions, the equipment supplier group described the idea that Keates *et al.* (2000, pg 1) label 'undue burden', that is "anything that would cost more than the able-bodied version". The necessity to keep costs down was decidedly two-fold; firstly the direct impact on company profit margins and secondly, the need to keep product offerings around established price points for cost-conscious purchasers. As one focus group participant surmised: "It's not functional if no one buys it", highlighting the importance of this latter requirement in ensuring that inclusively designed products actually reach fitness facility venues for disabled people to use. General focus group opinion was that many access issues were likely to be common across both impairment groups and equipment types. Solving selected problems could thus help a large number of disabled people and may not be particularly expensive or complicated to implement, however those design issues which would significantly increase final product cost would have to incur a premium for buyers in the marketplace.

Focus group participants recognised that in order to minimise expense and eliminate duplication of effort, it would be advantageous to work together on the development of an inclusive design standard. It was acknowledged that application of a design standard, and also inclusive design principles, need not necessarily increase product cost if requirements are reasonable and implementation occurs at a suitable point in the design process. Similar to the findings of Coleman (2001a), the use of a standard to rectify design exclusion was favoured in the early stages of the design process, where the greatest cost savings may be achieved.

Further interrogation of supplier representatives revealed that much of the apprehension surrounding increased expense stemmed from confusion between the concepts of designing for disability and inclusive design. The increased market-size potential of the latter approach as a way of recouping a return on any investment required was appreciated, and support was given for design changes that did not have a detrimental impact on non-disabled users. Fitness equipment design staff were encouraged to make technical contributions to the content of the inclusive standard to mediate this occurrence and a formal consultation period was included in the research approach (Chapter Six) to further facilitate their input.

The second most apparent concern, which specifically stemmed from selection of a design standard as the medium for disseminating inclusive design knowledge, surrounded stifling of designer creativity. Misgivings related to lack of product differentiation were voiced, with equipment designers worried that products “will all look the same”. For this industry, which has very similar base products and numerous product substitutes available to consumers, it was vital for manufacturers to be able to incorporate unique selling points into their designs. BSI (undated b) report this as a common myth surrounding standards usage and advocate that rather than inhibiting innovation, standards provide an information platform that then allows time for the creativity and invention required to drive product differentiation. Focus group discussions concluded that the inclusive design standard should concentrate, as a general principle, on performance rather than design requirements as these are less likely to inhibit innovation. Product designers can then be left free to use standards without diluting their own intellectual property or ingenuity. Fostering a good practice rather than a compliance culture may also offer greater freedom in design and product differentiation.

A typical consumer view of the accessible fitness equipment market is held by Petrick (2002), who suggests that:

"Strength equipment manufacturers have not recognized the potential market for this kind of machine, and when they do, it will still be many years before these machines can be developed, tested and enter the market at reasonable prices".

(Petrick, 2002, pg 4)

Supplier representatives identified with this description, particularly in terms of the efficiency of their ability to respond to changing market needs, thus there was strong support for a design standard that would allay these concerns by enabling accelerated time to market for new inclusive product developments. Modification of existing equipment was viewed as a potentially more rapid and inexpensive solution with shorter lead-in times compared to the development of completely new products. To further increase their competitive advantage, supplier representatives requested a staged approach to issuing a standard, hastening the infiltration of new inclusive design knowledge into the marketplace. Additional requirements could then be incorporated as research findings generated further understanding of the complexities of the subject. Agreement was reached between focus group participants that implementation of a standard incorporating inclusive design principles should offer no undue increase in product development times relative to those of other design approaches. Consolidation of relevant instructions into a single source should also enable product designers to work comfortably and competently within commercial resource and timeframe constraints. The importance of considering the standard in the earliest stages of the design process was reiterated.

In order to counteract the health and safety excuses sometimes used to justify a lack of equipment provision for disabled people, supplier representatives were concerned that the inclusive design standard followed the traditional precedent for standards to deal with health and safety, alongside risk management issues. Reduction of risk and potential liabilities were also important with particular reference to the safety requirements set out in the fitness equipment standard BS EN 957: Stationary Training Equipment (BSI, all dates). Although this standard does not explicitly include safety considerations for disabled people, focus group attendees refused to implement any design changes that would be in conflict with these criteria. Whilst the principal intent of the inclusive design standard was to improve functionality and usability, many of the requirements proposed to increase access would simultaneously address safety concerns. An important benefit of standardisation and also inclusive design should be to improve the suitability of products for their intended purpose, thus the inclusive design standard should enable safer access for a wider range of users.

The final major challenge associated with the uptake of an inclusive design standard, conveyed through collective focus group opinions, related to organisational priorities. Although not an outcome of choosing the methodological approach of developing a design standard, supplier representatives reported potential barriers to acceptance stemming from a lack of knowledge within their organisations concerning disability and impairment. Those with non-UK design departments faced further barriers with information sharing and the alignment of inclusive design practices with frequently conflicting international priorities. Supplier representatives suggested that the standard could be useful, alongside a précis of the business case for inclusive design, to educate and instruct colleagues. The provision of detailed specifications within the standard would additionally enable informed decision making by product designers, design commissioners, sales and financial teams as to the true resource implications of inclusive design.

5.5.6 Motivations for Participation in Standards Development

Focus group participants were content to work alongside competitors to lend their collective expertise towards producing meaningful documentation. Although involvement in a commercial forum raised some confidentiality concerns, support was gained for this shared work approach due to time and resource limitations. Supplier representatives reasoned that each would benefit from the knowledge transfer of good practice brought by a standard, to ensure products were fit for purpose. Small, single-product offering organisations, having comparatively limited resources, were particularly keen to work together to reap cost reduction benefits. The primary reason conveyed by all organisations for participation in the standards development process was to influence the content of the standard. Strategically, supplier representatives wished to be involved in shaping this emerging new area, with explicit value placed on the opportunity to gain advanced knowledge and insight into the standards' requirements. Enthusiasm was asserted for a formal procedure by which purchasers could reliably compare a supplier's inclusively designed products to those offered by competitors. Significant value was placed on the ability to brand-build and to encourage the consumer confidence and loyalty which, as BSI (2002) suggest, is associated with conforming to a recognised standard. Further important rationales cited by supplier representatives for involvement in the standard's development process included projected commercial gains from increased equipment sales and also avoidance of possible litigation against Disability Discrimination Act (HMSO, 1995; TSO, 2005) legislation. Promoting a positive company profile through a public commitment to inclusion was also a popular reason for participation.

5.6 Conclusion

Upon completion, the inclusive design standard was intended to be taken up by design teams within the commercial fitness equipment industry. It was therefore deemed prudent to extend the research to these stakeholders, in order to consider the commercial realities and constraints on such an endeavour throughout the standard's development process and subsequent implementation. Encouraging such input and negotiation of requirements was considered essential to secure publication of a meaningful and achievable design standard. This approach should also maximise the likelihood of future adoption and compliance to the standard by participating companies. The current chapter has therefore addressed research objective (3) by utilising a series of focus groups, attended by supplier representatives, to examine the barriers, opportunities and imperatives for the development of an inclusive design standard. From a methodological perspective the focus group technique was successful in gathering data relevant to the aims of the study, and candid and open discussion was achieved amongst a group of competitors who rarely work together. Consultation encompassed a wide cross-section of organisations, including many major players within the industry, suggesting findings should be broadly indicative of the UK fitness equipment industry as a whole.

Focus group participants corroborated the presence of design exclusion in many existing fitness products. Critical reasons uncovered for the widespread deficit of accessible equipment in the UK market were chiefly related to a small perceived market size and lack of practical information about designing for disabled people. To facilitate change, product design staff reported the need for knowledge concerning inclusive design which did not inhibit their creativity or individuality. Whilst rational concerns were described by supplier nominees during focus group sessions, there was overall agreement on the merits of developing an inclusive design standard. The development of a standard was advocated as a viable approach to enable equipment design to better meet the needs of disabled people within the industry, providing the following concerns were addressed:

- Development and final implementation costs should be minimised
- Target market size should be maximised
- Products should be capable of being developed with short lead-in times to market
- Technical content should be achievable, in terms of current manufacturing and production processes
- Consideration should be given to safety and risk management, whilst not negating established product safety requirements
- Suppression of designer creativity should be avoided.

The importance of these research findings was to provide information which would guide the content of the standard, to ensure that the business case for inclusive design was supported, alongside offering practical knowledge regarding its application. Direct involvement from equipment designers and also non-design related organisational representatives was indispensable in identifying these issues, with focus group sessions providing an agreeable and open forum for this essential dialogue. An appetite for inclusive design knowledge was found to exist and, for a myriad of reasons, supplier representatives were keen to participate in the development of a standard which would have a direct commercial influence on their industry. The evolving role of focus group participants, from providing feedback on generic commercial imperatives to offering specific technical contributions to the standard, indicated the importance of supplier involvement throughout the standard's development process. The key findings elicited in this chapter were subsequently utilised to filter user testing session data in order to determine the definitive content of the inclusive design standard. Chapter Six describes this synthesis of user and supplier stakeholder data in detail.

Chapter Six: Achieving Consensus on Content for the Inclusive Design Standard

6.1 Introduction

Standards are in essence codified knowledge; consequently drafting work does not generally begin until all the basic data are to hand (BSI, 1997b). As highlighted in Chapter One, drafting of the inclusive design standard for the fitness equipment industry could not commence until exploratory studies had been completed in order to obtain relevant basic data. Chapters Four and Five describe the acquisition of this knowledge from disabled users and commercial fitness equipment supplier design teams and organisations, after which the task of documenting the standard could begin, in order to present this information in a format more suitable for dissemination. It was necessary for the needs of all identified stakeholder groups to be amalgamated equitably to achieve agreement on the content of the final standard and thus meet research objective (4). This chapter describes the predetermined development process implemented to gain this necessary consensus. A comprehensive procedural commentary is provided here, with emphasis placed on conveying those decision-making processes used to cohesively merge conflicting stakeholder requirements. Excerpts from the original data sets have been utilised wherever possible to illustrate the evolution of the standard throughout the development process. Additional to the information provided in this chapter, a wider discussion is offered in Chapter Eight on the overall efficacy of the selected methodological approach in achieving a successful inclusive design standard.

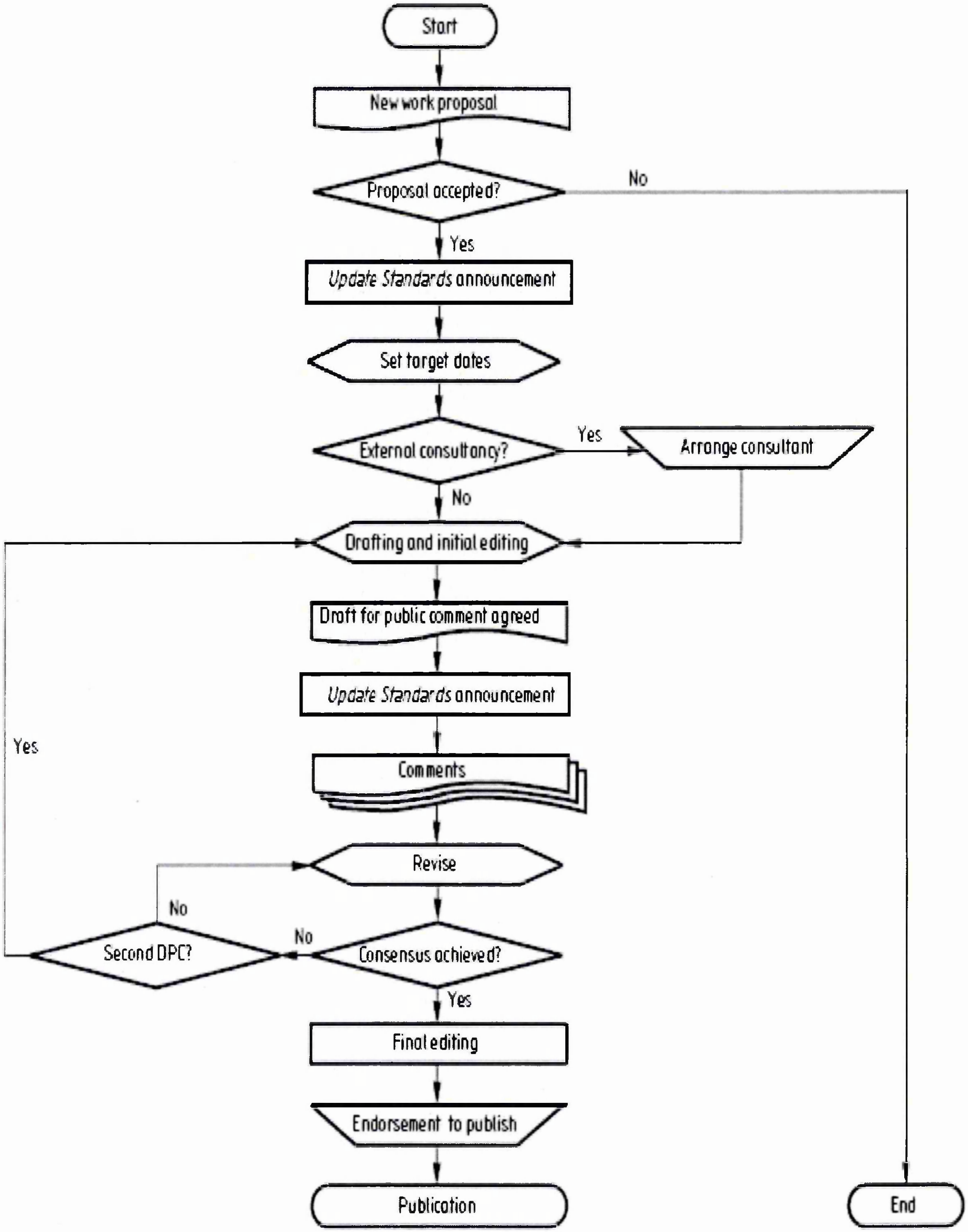
6.2 7-Phase Content Development Process

Whilst the approaches decreed by major organisations involved in standardisation vary in their detail, all develop standards using broadly similar methods. From inception through to publication, formally documented and controlled processes exist to ensure the transparency, fairness and general consensus of all standards (BSI, 2005e). The typical approach utilised by many national standards-setting bodies is illustrated in Figure 6.1, which offers a specific example of the development process of a British Standard (BSI, 1997b). According to BSI (2005d), this standard development process comprises of the 7 major phases identified in Table 6.1. The decision was made to adopt this 7-phase process, proffered by a recognised and respected national standards development body, for the development of the inclusive design standard. Implementing an analogous approach to that in operation at BSI was thought prudent to engender wide consensus and offer a transparency of approach. This latter requirement was deemed particularly relevant due to potential sensitivities regarding commercial competition within the fitness equipment industry. It was considered that adherence to this established method of development would maximise the validity, and hence likely acceptance, of the resulting standard by all parties. An overview of the process adopted for development of the inclusive design standard aligned with the 7-phase approach is provided for reference in Figure 6.2 and the individual development phases are now discussed in detail.

Table 6.1: Major phases in the development of a BSI national standard

Phase	Brief Description
1. **Proposal for new work**	Confirmation that new standard is needed
2. **Project acceptance**	Creation of a business case for the work
3. **Drafting**	Drafting of manuscript by appropriate experts
4. **Public comment period**	Broader audience comments on manuscript
5. **Approval**	Final content and approval to publish standard
6. **Publication**	Dissemination and announcement
7. **Review**	Periodic revision and maintenance

Source: Data from BSI, 2005d, pg 4



Source: BSI, 1997b, pg 25

Figure 6.1: Activities in the development of a BSI national standard

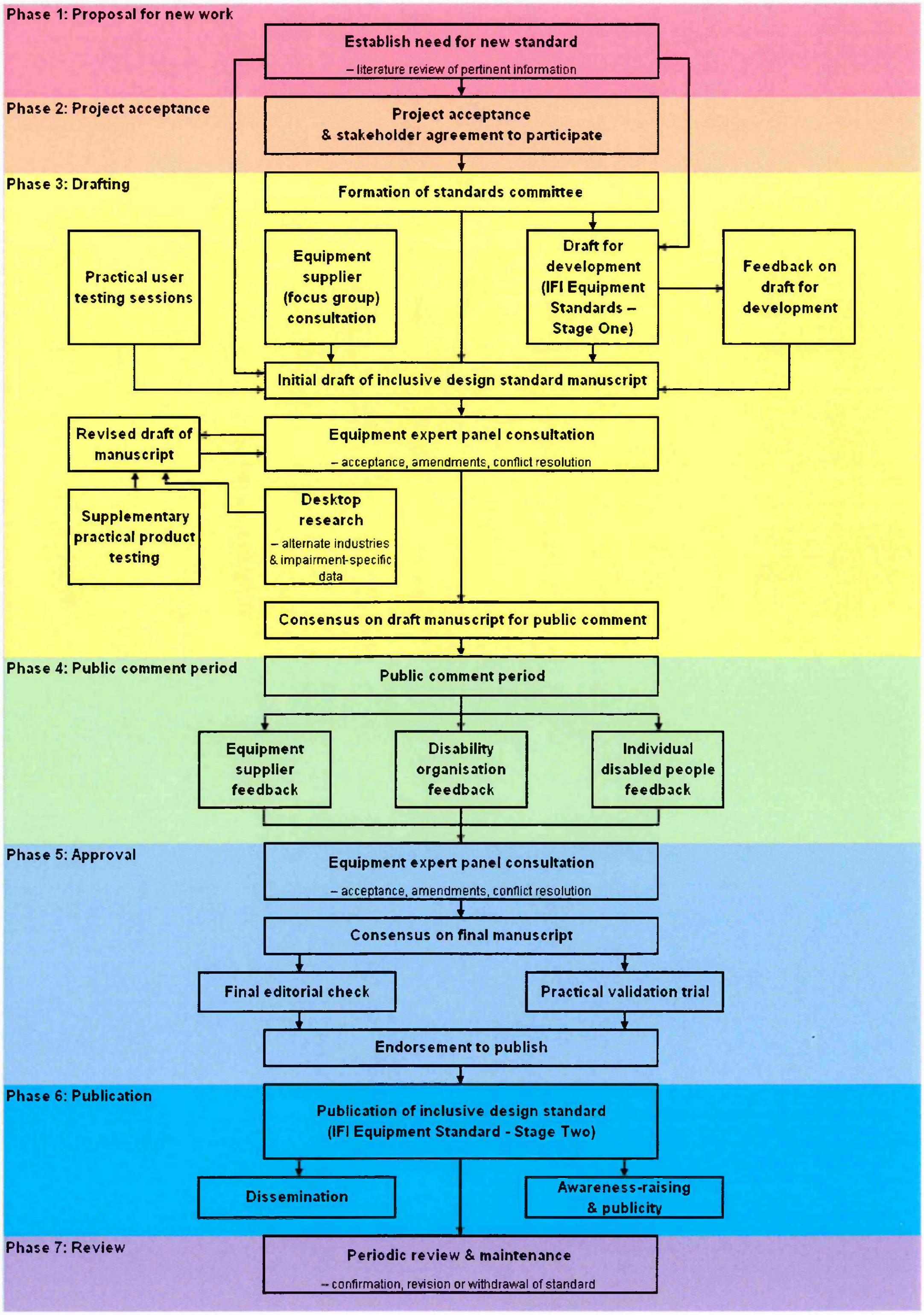


Figure 6.2: Inclusive design standard development process aligned to BSI 7-phase model

6.2.1 Phase 1: Proposal for New Work

The first step in the development of a standard is to confirm that a particular standard is needed (ISO, 2003b). In effect this opening phase is a feasibility study, where a review of existing standards and parallel activities in other organisations is undertaken to avoid unnecessary duplication. To assist in searching, the precise technical scope of the future standard must first be defined (ISO, 2003c). Thus, the remit of the inclusive design standard was set to encompass: 'the specification of general inclusive design requirements for Class S stationary training equipment as defined under the scope of EN 957-1 (BSI, 1997)'. This includes accessibility requirements for all gym equipment used in training areas of organisations, such as health and fitness clubs, where access and control is specifically regulated by the owner. Medical equipment or equipment intended for outdoor use or by children was expressly not included. As explained in detail in Chapter Two, a critique of available literature revealed no evidence of any previous work or published standard in this area.

6.2.2 Phase 2: Project Acceptance

The project acceptance phase extends the feasibility study of the earliest stage in the process of developing a standard. Alongside establishing a genuine need for standardisation in a particular area, research is required to assess if there is adequate interest in the field to enable a voluntary consensus to be reached (BSI, 2000). Major stakeholders must be identified and their support and commitment to actively participate in the project must be obtained. This research typically involves the creation of a business case (ISO, 2003b; BSI, 2005d). A business case for the inclusive design standard was established and conveyed to commercial fitness equipment suppliers through the focus group work described in Chapter Five. Assurances of participation were received from approximately 67% of the total industry, on the understanding that the standard development process would be:

- Based on consultation and consensus
- Resource and cost effective
- Respectful of confidentiality concerns
- Effective in satisfying current deficits in knowledge surrounding inclusive fitness equipment design
- Capable of providing for long term sustainability of inclusive design information within the industry.

This level of commitment was judged appropriate to achieve a consensus standard for the fitness equipment industry, and the adoption of the formal 7-phase standard development process shown in Figure 6.2 should satisfy the above stipulations for participation.

From the perspective of the disabled user stakeholder group, acceptance of the project was determined indirectly by the extensive evidence of low participation rates in physical activity by this group. Compelling accounts of inaccessible fitness equipment, accompanied by a handful of specific examples, were prevalent in the critiqued literature on the subject as discussed in Chapter Two. General dissatisfaction with current provision by disabled people, and those acting on their behalf, signified a call for action. The willingness of disabled individuals to participate in product testing indicated clear support from within this stakeholder group to contribute to the development of an inclusive design standard. Results obtained from this practical testing of fitness equipment additionally demonstrated a real need for change.

6.2.3 Phase 3: Drafting

With stakeholder commitment to collaborate on the project secured, work commenced on drafting of content for the standard's manuscript.

6.2.3.1 Formation of a Standards Committee

The drafting phase of any standard development process is almost without exception iterative and, typically, time-consuming. To facilitate more rapid progress, drafting is commonly performed by a small group or individual expert before undergoing wider consultation (BSI, 2005d). Specialist knowledge and a range of skills are required to secure the quality of the initial draft (BSI, undated a), thus formation of a standards committee inevitably involves recruitment of qualified representatives from groups concerned by the subject matter. Commercial companies, potential users and individuals expressing a more general interest may be amongst those participating (BNQ, undated).

Instigated in 2001 the 'equipment expert panel' was originally convened to act in an advisory capacity to the IFI on equipment-related matters. Due to the lack of publicised activity in the area, each member was selected and approached individually to be invited to serve on the panel, based on their technical knowledge, past experience, impartiality and interest in the subject area. In 2003 their role evolved to encompass responsibility for the development and corroboration of technical content for the inclusive design standard. Also known as the 'IFI Equipment Panel', this committee comprised of experienced industry experts in the fields of fitness equipment design, design legislation and safety standardisation, fitness instruction, inclusive (outdoor adventure) sports equipment design and disability equity. Also included were an IFI Programme representative, and a user representative and elected supplier representative drawn from individuals participating in the earlier user and equipment supplier studies. The multidisciplinary team of individuals who comprised the equipment expert panel throughout the standard's development process were:

<u>**Equipment Expert Panel Members**</u>

- **Mr Will Behenna**

  Organisation: Progress Training and Consultancy Ltd

  Field(s) of expertise: IFI Regional Co-ordinator
Disability Equity Trainer
User Representative

- **Mrs Sue Catton**

  Organisation: Inclusive Fitness Initiative / Montgomery Leisure Services

  Field(s) of expertise: IFI National Director

  Equipment Expert Panel Chairperson

  IFI Programme Representative

- **Mr Howard Davies**

  Organisation: British Standards Institution

  Field(s) of expertise: Chairman of BSI EN 957 UK Standards Committee

  Former Fitness Equipment Designer

  Elected Supplier Representative

- **Mr Spencer Holmes**

  Organisation: YMCAfit

  Field(s) of expertise: IFI Co-ordinator YMCAfit (2001 - 2003)

  Fitness Practitioner

  Fitness Training/Programming for Disabled People

- **Ms Dawn Hughes**

  Organisation: School of Engineering, Sheffield Hallam University

  Field(s) of expertise: PhD Researcher (Inclusive Fitness Equipment Design)

  Medical Physics and Clinical Engineering (NHS)

- **Dr Suresh Paul**

  Organisation: Equal Adventure Developments

  Field(s) of expertise: Inclusive Design Expert

  Inclusive (Outdoor Adventure) Sports Equipment Product Designer

  Academic Researcher

* **Miss Sara Wicebloom**

  Organisation: YMCAfit

  Field(s) of expertise: IFI Co-ordinator YMCAfit (2004 onwards)
  Fitness Practitioner
  Fitness Training/Programming for Disabled People

Tasked with negotiating the detailed specifications to be contained within the standard, this group offered expertise from their respective areas of the industry as defined above. Throughout their consideration of successive drafts of the inclusive design standard (as detailed below), panel members committed to ensure the resulting standard was fit for purpose and would achieve a wide consensus. During a series of 14 meetings, held at 2 to 3 month intervals between 3rd February 2003 and 24th April 2006, this working group made assessments, commentary and judgments on the developing standard. Although the greater part of the technical work was completed through discourse during these face-to-face meetings, interim correspondence also occurred via email and telephone discussions where necessary.

6.2.3.2 Draft for Development

Lead times for standards vary from a matter of months to several years (BSI, undated a). Consequently, it has become possible to publish interim documents at different stages in the standardisation process (ISO, 2003c). BSI describes a 'draft for development' as:

> *"a provisional document, developed under broadly the same processes as a formal standard and published when standardization of a particular subject is urgently required, but further research or development is required before it can be published as a British Standard."*
>
> (BSI, 2005e, pg 3)

Drafts for development offer intermediate specifications and are typically released early in product or technology cycles when guidance is critically needed. Offering insights into new or developing areas, before the development of a full standard, these informal standards can enable companies to plan business developments and give early competitive advantage (BSI, undated b; BSI, 2005d).

Release of a draft for development was judged fitting in the case of inclusive design for the fitness equipment industry due to the complete originality of the topic under investigation. Owing to the newness of this area of interest, many iterations of the manuscript were foreseen. To ensure useful design information entered the commercial domain as soon as reasonably practicable, and aware that it would take time to develop a consensus standard, the decision was taken to publish an interim document. This approach would satisfy the expressed need from focus group participants for immediate and practical inclusive design information (outlined in Chapter Five) and, importantly, would maintain equipment supplier interest, momentum and input into the work. A staged approach to the introduction of the standard was also considered advantageous in allowing a more gradual industrial change process to occur. Giving opportunities to trial practical implementation of basic inclusive design requirements would enable equipment supplier design team education and feedback. Moreover, a wider organisational assessment of the merits of inclusive design could also be made by equipment suppliers. Challenges associated with adoption of a completely new design approach could be exposed, and addressed, where necessary. Such experiential learning would be valuable for the development, management and execution of the forthcoming standard and would additionally afford the equipment expert panel the ability to integrate any emerging new best practice.

Entitled the 'Inclusive Fitness Initiative Fitness Equipment Standards - Stage One', the draft for development was released on 1st April 2004 and issued a little over 12 months after commencement of the project, which aligns with predicted timescales from BSI for production of such documents (BSI, 2005d). Published with the expressed intent of being replaced with a more comprehensive, wide-ranging and complete standard, the draft for development would remain unchanged until superseded by the 'Stage Two' version, due for publication in mid-2006, offering a two-year period of stability to the industry. The 23-page draft for development, provided in full in Appendix G, was based upon the early findings of the investigation presented in Chapter Four, modified by comments and discussions in the meetings of the equipment expert panel. Negating public comments and forgoing a wider consensus is considered acceptable in the case of drafts for development to speed time to market (BSI, 2005b). A total of 13-pages of design requirements were presented, accompanied by cover and title pages, contents listing and a foreword. The design requirements encompassed general inclusive design criteria for all product types, alongside those specifically applicable to strength training-type equipment, consoles, bicycles, treadmills, upper body ergometers, rowing machines, steppers and cross trainers. As an example, Figure 6.3 illustrates the design requirements for strength training-type equipment. Data used in the production of the standard was heavily biased towards the professional experience of equipment expert panel members, with casual observations of disabled users during practical equipment testing sessions, providing some additional information. At this point no formal analysis of the test session data was available, thus knowledge acquired from the sessions was of perceived user needs, based only on informal and incidental observations. These intuitive results were also supplemented by the limited knowledge relating to solutions to inaccessible fitness equipment design previously captured within published literature (see Chapter Two).

inclusive fitness

Strength Training Equipment

Inclusive Fitness Initiative
Fitness Equipment Standards – Stage One
1st April 2004 to 30th April 2006

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disability
Enclosed weight stack meeting the requirements of EN957 Part 2 – for third party protection	✓	✓	✓		✓
Stability testing as per BSEN 957 Parts 2 Weight Machines and Part 4	✓	✓	✓		✓
Locking key weight selection mechanism	✓	✓	✓		✓
Weight selection pin to be tactile and have definite colour contrast to the weight stack			✓		✓
Raised tactile numbers on the weight stack			✓		
Following machine parts to have definite colour contrast from remainder of the machine: • Seats - contrast against frame			✓		✓
• Adjustment mechanisms			✓		✓
• Bar ends			✓		✓
• Interfaces					✓
Adjustable start positions where necessary to prevent starting in a stressed position	✓	✓	✓		✓
Stability handles or points for use during functional exercise	✓			✓	
Low start weight relevant to the piece of equipment	✓	✓			
Hand rails accessible to ensure that users are able to actively support their torso during activity	✓	✓			
Seating system independently moveable (e.g. swing away seat) or removable by wheelchair user wishing to exercise from their own chair for all upper body strength equipment		✓			

Figure 6.3: Strength Training Equipment excerpt from draft for development

The draft for development was prepared and approved in the knowledge that there would be limitations on the requirements which could be endorsed for insertion into the document. Detailed quantitative design information was lacking in certain areas due to voids in knowledge about exact user requirements and the most effective ways of satisfying user needs. Further research and investigation would ultimately be performed to fill these knowledge gaps. Consequently, the draft for development tended towards being descriptive and informative rather than overly prescriptive. Excerpts from the draft for development illustrating this narrative approach are presented in Figure 6.4. Also omitted from the draft for development were criteria demanding lead-in times in excess of two or three months. Although inclusive design normally requires consideration of user needs at the start of product development (Keates and Clarkson, 2003a), the standard was intentionally set to allow 'retrofitting' of solutions to products already in existence to reflect commercial sensitivities. Enabling all participating equipment supplier design staff to utilise the draft for development, regardless of their current position within product design lifecycles, was important for equity and educational reasons. Integral accessibility would however be increasingly demanded as the draft for development matured into the full inclusive design standard. A combination of 'essential' and 'desirable' criteria were included in the draft for development, as illustrated in Figure 6.4, the latter giving forewarning of likely future inclusions in the standard, effectively extending the implementation time available for these requirements.

inclusive fitness

Treadmills

Inclusive Fitness Initiative
Fitness Equipment Standards – Stage One
1st April 2004 to 30th April 2006

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disability
Distinctive marking on belt to allow user to determine if belt is moving			✓		✓
Visible contrast between the running belt and the casing			✓		
Quick or single button start			✓		✓
Maximum 1kmph start speed		✓	✓	✓	✓
Low incremental changes in speed		✓	✓	✓	✓
Functional hand rails provided for a minimum one third the length of the training surface. (As per EN957 – Part 6)	✓	✓	✓	✓	✓
Rear roller guard or similar protection (as per EN957 – Part 6)			✓		
Visual feedback about performance at the end of the workout				✓	✓
Guard rails provided for one third the length of the training surface (as per EN957 – Part 6)					✓
Bilateral access		✓			
Impact absorption system available		✓			
Centrally located emergency stop or emergency stops located on both the left and right hand sides of the equipment or kill cord or similar 'hands-free' option for emergency stop	✓	✓	✓	✓	✓

Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disability
Auditory feedback about performance at the start and end of the workout			✓		✓
Low level step on and off		✓			

Figure 6.4: Treadmills excerpt from draft for development illustrating 'essential' and 'desirable' criteria

Although not without expected shortcomings, the draft for development represented an important first step towards inclusive design guidance specifically for the fitness equipment industry. Drafts for development offer an opportunity for users to feed back information as part of a process of continuous improvement of any given standard (BSI, 2005d). Reinforcing the iterative nature of standards development, this initial document was crucial for informing the development and future content of the inclusive design standard. Critiques on practical execution of the draft for development were sought from equipment supplier design staff through the focus group sessions described in Chapter Five. Constructive criticism, technical contributions and direct questioning of supplier representatives over subject matter all fed into the developing standard's content, as did tacit knowledge accrued by the author at these sessions. Gym users' and fitness instructors' opinions on products in the marketplace, which met the draft for development requirements, were gathered through telephone and email communications directed via the IFI office. This feedback on the implementation of the draft for development allowed pertinent information to be incorporated within the ensuing inclusive design standard. The ongoing progression from draft for development to fully published consortium standard is described below.

6.2.3.3 Iterative Development of Content

As outlined in Chapter Four, the main data forming the inclusive design standard, intended to replace the draft for development, was obtained from analysis of user feedback from practical equipment testing sessions. Standards often have multiple parts, sections or sub-sections to facilitate ease of reference and use (BSI, 2000). Following this precedent the fitness equipment safety standard BS EN 957 (BSI, 1997a) presents a generic Part 1, applicable to all products, followed by seven equipment-specific Parts. An early decision was taken to align the format and structure of the inclusive design standard to that of BS EN 957, offering familiarity to product designers and the equipment expert panel alike. This commonality of approach would support cross-referencing of requirements, development of consistent terminology and would strengthen any future alliance between the two standards. During data analysis, therefore, qualitative user feedback from the practical equipment testing sessions was collated into generic product categories reflecting those of BS EN 957 (see Chapter Four). Consequently the inclusive design standard would offer the following ten Parts, with individual Part numbers and titles matched faithfully to the designations of BS EN 957 wherever possible:

Part 1 – General Requirements
Part 2 – Strength Training Equipment
Part 3 – Free Weight Equipment (Weight Benches, Racks, Barbells and Dumbbells)
Part 4 – Consoles
Part 5 – Cycles
Part 5A – Upper Body Ergometers
Part 6 – Treadmills
Part 7 – Rowing Equipment
Part 8 – Steppers, Stairclimbers and Climbers
Part 9 – Elliptical and Crosstrainers

Presentation of accumulated user feedback by generic product categories, and all prior data analysis, was completed solely by the author. In the first instance information was collected, coded and sorted with no acceptance or rejection of criteria. Once all data were recorded discretion was used, based on the author's industrial experience, to remove highly inappropriate criteria. Discarded information typically related to requests far beyond current technological capabilities or the reasonable financial resources of equipment supplier organisations. With this first filter applied the documentation represented the earliest and original working draft of the inclusive design standard. A small excerpt for treadmills is shown in Figure 6.5.

Session / Equipment ID	Tester ID & Impairment Category	Comments
2 / 16	747 Cerebral Palsy	Step could be added at side to step onto and off using hand rail to balance
2 / 41	749 Cerebral Palsy	Be good with extra long side handles for extra balance
3 / 1	1312 Multiple Sclerosis	Safety rail and hand grips very good for confidence
5 / 34	1347 Dwarfism	It could do with a lower grab bar
3 / 41	735 Multiple Sclerosis	Could not set slow enough for my needs
3 / 41	1314 Non-disabled	Same display as the other machines good for simplicity/continuity
1 / 17	470 Visual Impairment	Need simpler start up procedures on technology accessible for visually impaired people
4 / 38	751 Visual Impairment	Touch screen so no good
3 / 2	729 Visual Impairment	Raised buttons particularly for the speed and gradient would be important for independent use
3 / 17	751 Visual Impairment	Different sounds for different buttons on display would be good
2 / 41	750 Visual Impairment	Controls were very good because of different shapes
3 / 1	1309 Learning Disability	Picture symbols use i.e. tortoise
3 / 17	1311 Multiple Sclerosis	Unable to press buttons needed quite a bit of force
5 / 26	1463 Visual Impairment	Due to size of fonts it is difficult to access programmes
5 / 26	3489 Non-disabled	Instructions/warning info extremely small!!
5 / 34	3489 Deaf/Blind	Emergency stop button needs to be larger
5 / 26	4796 Multiple Sclerosis	[Good stop button] within easy reach (if you're right handed)
3 / 29	4784 Hearing Impairment	Very good but I don't feel safe in it because if I fall back there is no wire attached to me for emergency stop
3 / 1	729 Visual Impairment	Good safety features, white moving logo good – indicates treadmill is working – perhaps horizontal white lines would be added to this
3 / 17	729 Visual Impairment	White logos helped identify when treadmill working but black colour makes edges difficult to see
2 / 16	729 Visual Impairment	Contrasting colour between the belt and sides would be beneficial-even a white or yellow line along the edge
5 / 26	4796 Multiple Sclerosis	Very good that they provided Braille manual

Figure 6.5: Example of accumulated and filtered user feedback for the treadmill generic product category

The full text of the draft for development was incorporated into the documentation alongside the filtered qualitative user feedback. Forming the foundation for all subsequent drafts of the inclusive design standard, this manuscript was then submitted for consideration by the equipment expert panel. Assessments, commentary and judgments on the draft were made through deliberations at equipment expert panel meetings, where a line-by-line analysis accepted or rejected each individual criterion outright, or referred it for modification or further research. Details of the decision-making processes and prioritisation strategies utilised in making these judgements are discussed in detail in section 6.2.3.6 below. Following each meeting the working manuscript was amended to reflect all agreed changes and the script resubmitted to the subsequent meeting for approval. The evolving standard remained a confidential, internal document, with relevant segments only released for external comment where necessary.

Keeping the needs of disabled people at the core of the inclusive design standard was an overarching priority for the equipment expert panel. Maintaining a positive focus on functional ability was considered vital, therefore a large number of the requirements were rewritten to be presented in terms of product specifications and not personal abilities. This approach offers natural parity with the intention of standards to set out clear performance objectives which focus on the product and not on the abilities of its user (BSI, undated a; BSI, 2005f). To illustrate, a tester with muscular dystrophy offered the following feedback on accessing a piece of upper body strength equipment:

"With a battery wheelchair, the wheelchair prevented me getting far enough back."

(Tester, Muscular Dystrophy)

The equipment expert panel took the polar view that it was in fact the design of the fitness equipment, not the battery on the wheelchair, which was impeding this user's access. In order to address the issue raised by this user's statement, the requirements shown in Figure 6.6 were incorporated into the final inclusive design standard.

1.1. Access and Set Up / 1.2. Seats

Req. No	Title	Standard	Method of Verification
1.1.1	Access and Transfer	The frame and other structural parts of the equipment shall not interfere with easy transfer and access onto or egress from the equipment. The equipment shall be capable of being accessed from the maximum number of approach angles as practical. The equipment shall require a minimum range of movement and co-ordination from the user to allow access to and egress from the equipment.	VE PT PT
1.2.3	Re/Moveable Seats	Unless specifically advised in the relevant Part of the Standard, all upper body exercise equipment for which a seat is provided must allow the seat to be re/moved to permit users to exercise from their wheelchair. When the seat is re/moved the remainder of the equipment must be sufficiently stable to permit normal, safe use.	PT
1.2.4	Clearance	Once the seat is re/moved, the remaining area must be free of physical obstructions above the height of 15mm measured vertically from the ground to allow a wheelchair user to adopt a stable and safe exercise position.	DC

Figure 6.6: Access and Set Up / Seats excerpt from inclusive design standard showing product requirements to enable wheelchair access

In order to provide clear, unambiguous design requirements, the inclusive design standard aimed to be more definitive, quantitative and precise than the draft for development or qualitative user feedback alone. Removing unnecessary subjectivity would also aid compliance, objectively ensuring that comparable products passed conformity testing. It is not unusual for a standard to be drafted by a small panel or individual expert using existing standards or data from various sources as appropriate (BSI, 2000). Alternative sources of data were therefore sought to strengthen the content of the standard and, where necessary, to satisfy gaps in knowledge as reviewed below.

6.2.3.4 Utilising Existing Data Sources

According to BSI (1997b, pg 27), "a standards body seeks to codify existing knowledge, not to establish new facts". Whilst the accuracy of this statement with regard to original information may be questioned, the use of existing knowledge is commendable. Data obtained from authoritative sources can increase the validity of a standard, thus such information was utilised wherever possible to populate the developing inclusive design standard. As well as being time-efficient, this approach ensured the detailed content of the standard reflected best practice at the time of writing. Pre-existing inclusive design information was considered as a priority wherever it was available. As an example, the 'Sign Design Guide: A guide to inclusive signage' (Barker and Fraser, 2000) suggests a minimum embossed character height of 15mm on building signage which is intended to be read using touch by individuals with very limited or no vision. This advice directly informed the minimum requirements stipulated for the height of tactile weight stack numbering to be implemented on strength equipment to identify available weight increments. Research also focused on alternative industries who had specifically considered the incorporation of people with impairments. A review of architectural standards proved beneficial, with 'BS 8300: Design of buildings and their approaches to meet the needs of disabled people' (BSI, 2001) offering particularly pertinent information. Impairment-specific literature, more often than not produced by national disability organisations, was additionally consulted.

Mencap's guide to writing accessibly for people with learning difficulties, 'Am I Making Myself Clear?' (2002), and the Royal National Institute for the Blind's advice on producing literature for those with visual impairments, 'See It Right' (1999), were particularly valuable. It was distinctly noticeable that available inclusive design information was heavily biased towards architecture and the written word rather than physical products. This left areas in the inclusive design standard for which explicit requirements remained absent. These voids were subsequently filled through additional practical product testing.

6.2.3.5 Supplementary Practical Product Testing

There are times "when a committee may need to initiate or extend research in its field in order to complete or strengthen a standard" (BSI, 1997b, pg 27). Following assimilation of applicable design information from a range of existing sources, there remained areas of the inclusive design standard for which no constructive data was available. Supplementary practical product testing by disabled people was thus chosen to provide empirical data to support the standard. Practical testing of equipment was considered the most viable method to facilitate problem solving and provide information specific to fitness products. Additionally this method would ensure the content of the inclusive design standard remained user-led. The research brief for testing prioritised areas where the greatest deficits in knowledge existed and focused on the inclusion of those users deemed most excluded by current fitness equipment design. The needs of people with sensory impairments and individuals with limited hand function and/or finger dexterity were particularly noted, due to the significant amounts of adverse feedback emanating from these groups during initial product testing. Developed in collaboration with the equipment expert panel, the research brief targeted for further investigation the broad areas of: clear and easy access onto equipment; ease of use of adjustment mechanisms, particularly for unilateral use; simplicity of programming; and use of multi-sensory information on user-product interfaces (incorporating auditory feedback, tactile labelling and effective use of colour). Thirty individual test scenarios were established and tests conducted to elicit equipment and component specific information for direct integration into the standard's documentation. The photographs in Figure 6.7 illustrate two of these practical test sessions. Figure 6.7(a) shows investigations into the effect of varying the pin shape on the ease of selecting different weight adjustments on strength equipment. Figure 6.7(b) demonstrates a test into the effectiveness of adding raised tactile information to control consoles on cardiovascular equipment.

A questionnaire-based research approach analogous to that used in Chapter Four was implemented to capture more detailed user needs. These latter studies however, encompassed a more prescribed and explicit tester selection. Individuals with maximum product usage and evaluation experience were selected alongside a small number of 'new-to-product' testers. Testers were also, importantly, matched by specific functional impairment to perform particular tests. For example, 7 testers with limited finger dexterity, often through the effects of arthritis or a stroke, tested the ease of selecting different weight adjustments using various adjustment pin shapes (Figure 6.7(a)). Likewise, a total of 23 blind, visually impaired or deaf/blind testers participated in extensive tests evaluating the effectiveness of adding raised tactile information to control consoles (Figure 6.7(b)). This procedure for tester selection is comparable to the lead and critical user concepts defined by Von Hippel (1986) and Keates and Clarkson (2003a) respectively. Lead users are users whose present strong needs will become general in a marketplace months or years in the future. Correspondingly, critical users represent the borderline cases between being able and not being able to use a product. Such individuals are believed to act as a good forecasting mechanism for future product needs and can often highlight problematic areas and demonstrate novel and innovative solutions.

(a) Ease of weight adjustment selection with varying weight pin shape

Figure 6.7: Examples of supplementary practical product testing by disabled users

(b) Effectiveness of adding raised tactile information to control consoles

Figure 6.7: Examples of supplementary practical product testing by disabled users

Questionnaires were designed to encourage respondents to consider and compare individual product components and state preferences when presented with multiple options for achieving the same outcome. The test description and questionnaire for assessing ease of weight adjustment selection with varying weight pin shape (Figure 6.7(a)) is given, along with two completed surveys, as an example in Appendix H. This increasingly specific and comparative testing offered greater clarity on the optimal solutions preferred by testers in each area. Significant findings from the practical testing were incorporated, as appropriate, into the inclusive design standard documentation. As an example, the draft for development offers the requirements shown in Figure 6.8 surrounding tactile information on the main control consoles of cardiovascular fitness equipment. Although the draft for development dictates the provision of either buttons which are entirely raised or tactile iconography within the constraints of the button, no quantitative information is supplied. As a direct result of the supplementary practical testing, with a small amount of supporting information obtained from existing data sources, the tactile information section of the inclusive design standard was expanded as shown in Figure 6.9. This is indicative of the expansion of requirements and provision of more detailed information between the draft for development and the inclusive design standard. The latter is hence seen to be more definitive, quantitative and precise, removing a large degree of subjectivity compared to the draft for development (Baker, 2006).

inclusive fitness

Consoles

Inclusive Fitness Initiative
Fitness Equipment Standards – Stage One
1st April 2004 to 30th April 2006

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disability
Raised obvious iconography (pictures, images, logos) and, or raised digits, and or raised buttons on console for main controls (start/stop, up/down, increase/decrease speed) with clear colour contrast. (The raised digits should not be Braille. If Braille is to be added this should be along side the raised digits)			✓		✓

Figure 6.8: Consoles excerpt from draft for development illustrating tactile iconography requirements

4.6. Tactile Feedback

Req. No	Title	Standard	Method of Verification
4.6.1	Tactile Border	All Main Controls must have a tactile border with a minimum raised height of 200 microns (and ideally 400 microns), or the whole button must be raised, with a minimum raised height of 2mm, from the background surface to allow identification of the button location.	TC/DC
4.6.2	Button Content	All Main Controls must have raised iconography, a raised distinctive texture, raised characters or raised text contained within the button. Numeric (0 to 9 inclusive) keypads are exempt from this requirement if presented in a standard telephone or calculator layout and a suitable tactile indicator is provided on the number 5 from which subsequent navigation can occur.	TE
4.6.3	Meaningful Iconography	Iconography and characters used on the Main Control buttons must be appropriate and meaningful.	VE
4.6.4	Raised Iconography Size	Raised iconography used on the Main Controls must have a minimum icon size of 10mm.	DC

Figure 6.9: Consoles excerpt from inclusive design standard illustrating tactile iconography requirements

(Figure continued overleaf)

4.6.5	Raised Text Size	Raised text used on Main Controls must have a minimum font size of 11mm for the smallest letter height and a minimum font size of 15mm for the capitalized letter height. Text which is only 1 or 2 characters in length will be classed as an iconography (see Requirement 4.6.4 above).	DC
4.6.6	Tactile Text Size	Text of more than 1 or 2 characters in length should not be tactile to avoid tactile confusion if the minimum font size is less than 11mm for the smallest letter height and a minimum font size of 15mm for the capitalized letter height.	TE
4.6.7	Raised Height	Where raised information is required on the Main Controls on the console it shall be a minimum raised height of 200 microns (and ideally 400 microns). Numeric (0 to 9 inclusive) keypads are exempt from this Requirement if presented in a standard telephone or calculator layout and a suitable tactile indicator of minimum raised height 200 microns (and ideally 400 microns) is provided on the number 5 from which subsequent navigation can occur.	TC/DC TE
4.6.8	Fit For Purpose	Any raised information must be integrated within the console and be fit for purpose, durable and of a suitable material.	TE
4.6.9	Braille	The raised iconography should not be Braille. If Braille is to be added this should be alongside the raised iconography.	VE

Figure 6.9 (cont.): Consoles excerpt from inclusive design standard illustrating tactile iconography requirements

6.2.3.6 Conflict Resolution Strategies

Overall, the approach of collating existing design data from authoritative sources supplemented with practical product testing, was effective in providing constructive content for the inclusive design standard. Occasionally, comparison of seemingly like information from different data sources highlighted inconsistencies, as did attempts to simultaneously service the requirements of all stakeholders. Conflicts were apparent both within and across stakeholder groups. Users with physical impairments, for example, typically requested multiple adjustments be available on equipment to allow for a variety of body shapes and ranges of movement. Conversely, users with cognitive impairments often wanted equipment without any adjustment mechanisms, making products more simple and straightforward to use. This situation was further complicated by the fact that impairments do not necessarily occur in isolation. Mencap (2003) for example, indicates that learning difficulties are frequently accompanied by physical impairments, whilst Badley and Tennant (1997) report that there is a likely incidence of sensory impairment occurring in combination with other physical disabilities. Multiple impairments are also common amongst the aging population where combined vision and hearing loss is not unusual (Age Concern, 2008). The compound effects of several impairments which suggest contradicting product design requirements could therefore be apparent not only across different users, but also within any one individual. Further conflicts were additionally evident across different stakeholder groups. Major tensions between user and supplier groups centred on the provision of increased product functionality against the technological challenges and associated costs involved in delivery. A significant number of visually impaired users requested the addition of extensive auditory feedback to cardiovascular equipment to assist with independent use and programming. Current embedded hardware in these products proved unable to provide appropriate auditory outputs, with extensive hardware and software upgrades required to remedy this situation. Incurring significant expense and long lead-in times to develop, the addition of extensive auditory feedback was unlikely to be commercially viable to supplier organisations in the short term. Although desirable from a user perspective to demand high levels of auditory feedback within the standard, it was obvious that concessions would have to be made on the content of the inclusive design standard surrounding this issue.

The equipment expert panel assumed responsibility for balancing all incongruent requirements, acting as an independent third party conciliation service between competing stakeholders. Using all available data to inform their decisions, autonomy was given to the panel to make a final decision on the technical content of the inclusive design standard. To arbitrate requirements, and ensure benefits bestowed to one stakeholder group were not to the unreasonable detriment of another, the equipment expert panel implemented the prioritisation hierarchy summarised in Table 6.2. For inclusion in the standard any design requirement had to compare favourably with the hierarchy. In the case of two or more competing requirements being apparent, this hierarchical arrangement was used to determine which, if any, should take precedence for insertion into the manuscript.

Unsurprisingly, health and safety issues formed the prime concern in the prioritisation hierarchy. Standards need to provide for levels of safety that will give protection from harm, and in the course of preparing a draft standard inclusion of provisions relating to health and safety should always be considered (BSI, 1997b). Any design requirement that had the potential to make a product fundamentally unsafe was rejected outright from incorporation within the inclusive design standard, whereas conversely, requirements which would make products safer were prioritised for inclusion. Design modifications were also discarded if they would contravene the safety specifications for fitness equipment set out within BS EN 957 (BSI, all dates), as requested by supplier representatives during the focus group sessions. To manage risk and minimise hazards wherever possible, compliance with BS EN 957 was set as an explicit prerequisite to meeting the inclusive design standard. Requiring compliance with BS EN 957 permitted the inclusive design standard to incorporate safety requirements whilst maintaining its integrity and purpose as a standard primarily focused on accessibility and inclusion.

Following on from health and safety issues in the prioritisation hierarchy were deliberations on commercial viability and the practical achievability of the design requirement. As explicitly requested by representatives attending focus group sessions, cognisance was taken of restrictions on cost, technological capabilities and anticipated timescales. Accurate cost assessments and information on current product features were sought from supplier design staff via focus group sessions when required. Inclusive design criteria efficient in the use of materials and human resources were preferred for inclusion within the standard. To control variety and minimise costs, standard dimensions were selected wherever possible.

Table 6.2: Prioritisation hierarchy used to resolve conflicting stakeholder requirements

	Priority Issue	Considerations...
1	**Health & Safety / Risk Management**	• User health and safety, including appropriateness of the exercise to be performed • Based on risk assessment of making and/or not making design changes • Avoidance of conflict with existing and established access or safety requirements (particularly BS 8300 and BS EN 957)
2	**Commercial Viability**	• Likely practical achievability • Implementation cost and market share influence • Resource allocation – materials, human resources etc • Manufacturing and technology limitations • Ease of change implementation • Expected lead-in time
3	**Level of Inclusivity**	• Potential impact / anticipated level of inclusion of disabled users – referring to user epidemiology and demography as appropriate • Frequency of incidence / severity of design exclusion reported by disabled people during practical testing • Bias towards including most excluded user groups • Detrimental impact of change on alternative user groups • Alliance with 'inclusive design' rather than 'design for disability' approaches
4	**Availability of Design Data**	• Quality, reliability and consistency of data sources • Preference for established, authoritative sources and quantified requirements • Practical or observational experience to support potential success of making design change
5	**Test Methods for Compliance**	• Test methods achievable with minimum expense and specialist equipment • In-house testing possible (to avoid external test house costs)

Anticipated level of inclusion was considered next in the prioritisation hierarchy to counter purely commercially-based considerations. An indicative assessment was made of the impact and success of any proposed criteria with regard to its ability to include a wider range of users. A degree of certainty that a requirement would include more users had to exist for any criteria to be incorporated into the inclusive design standard. Confidence in the outcome of a design change was judged by the equipment expert panel based either on their professional experience or specific user observations at practical testing sessions. Requirements that maximised inclusion were typically retained within the design standard, particularly if they offered a positive impact across multiple impairment groups. Another key concern was the severity of design exclusion currently experienced by certain user groups. The requirement for a removable seat to allow wheelchair access to upper body strength equipment was inserted into the design standard on this basis. Without removable seats such products are rendered totally unusable from a wheelchair and any subsequent design changes made to accommodate wheelchair users would be futile. Although wheelchair users represent less than 5% of the total disability population (Health Education Authority, 1997), the high level of design exclusion encountered compelled the inclusion of this relatively impairment-specific requirement. The removal of equipment-related barriers to participation in physical activity was actively pursued for certain user groups. Research conducted in association with the IFI suggests that people with sensory impairments attend gyms with the lowest frequency compared to other impairment groups (Sutton, 2004). A strong emphasis was thus placed on the needs of visual and hearing impaired individuals to encourage and facilitate their increased participation. Requirements surrounding provision of raised tactile information, use of colour and appropriate text sizes therefore feature prominently within the standard. In considering the needs of those with impairments, care was equally taken to limit the detrimental impact of any proposed design changes compared to current product usage. A focus on inclusive design rather than design for disability was maintained, with the needs of a range of disabled and non-disabled people catered for throughout the content of the standard.

The penultimate area for consideration in the prioritisation hierarchy was the availability of design data. In response to equipment supplier design staff requests for a definitive standard with limited subjectivity, precise dimensional and other quantitative information was included where it could be reliably sourced. Where differing sources offered conflicting advice on a particular aspect of design, precedence was given to the source judged most authoritative and trustworthy. Confidence was generally placed in existing British or European standards and publications by national disability organisations that were recognised as experts in their field. Information specific to fitness equipment, although very limited, was also considered favourably. In the absence of any applicable design information, it remained necessary in some areas of the standard for content to be completed by conjecture on the part of the equipment expert panel. In cases of dispute, the professional opinion and technical expertise of the most relevant panel member was normally acknowledged. Only a small number of areas were completely dismissed from the standard due to a lack of sufficient or reliable design data. Most notably, the widespread provision of auditory feedback on products was negated in part due to a shortage of information. Auditory requirements were targeted for future integration into the standard, during a periodic review, once a more comprehensive programme of research could be conducted in this specific area.

Consideration of test methods for compliance was the concluding area in the prioritisation hierarchy. Knowing how to test and ensuring that like products pass such tests is important to verify conformity of products against specifications (BSI, 2005d). Every criterion within the inclusive design standard was therefore prescribed an associated test method through which conformity could be asserted. To minimise costs, all selected test methods for design criteria were chosen to be self-administered without the need for expensive, specialist measuring instrumentation. In order to verify this, and to ensure that methods were not specified in the standard without having been first tried out in practice (BSI, 2005f), the author and a colleague from the equipment expert panel performed trial runs of each assigned conformity test.

Application of the prioritisation hierarchy outlined in Table 6.2 was complex, requiring extensive discourse and debate amongst equipment expert panel members. Discussions centred on the principal question of "what is a *reasonable adjustment*?" - an approach based firmly on the legislative wording utilised within the Disability Discrimination Act (HMSO, 1995; TSO 2005). The need to ensure that no one stakeholder group benefited from an intervention at the unfair expense of another was the primary concern in answering this key question. As well as applying collective knowledge and experience the equipment expert panel frequently used cognitive walkthrough techniques during discussion meetings to aid understanding. Cognitive walkthrough offers a style of expert review which heavily utilises 'user-scenarios' and attempts to view navigation of products through the eyes of the user (Allen, 2002). Comparison tests between competing fitness products and between previous designs and new designs were also repeatedly employed to aid decision-making and ensure appropriate parity across stakeholder groups.

6.2.3.7 Achieving Consensus on the Draft Manuscript

Standardisation relies on consensus (BSI, 1997c). Numerous iterations of the manuscript and a succession of meetings were required before consensus was reached by the equipment expert panel on the content of the inclusive design standard. According to BSI (2005b) and ISO/IEC (2004) consensus need not imply unanimity and may be defined as a:

> *"general agreement, characterized by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments."*
>
> (BSI, 2005b, pg 3)

Under this description partial consensus is acceptable. From this perspective the solution to the particular problem being considered "is therefore that judged by the majority to be the most favourable for application at that specific time" (ISO, 2003d, pg 1). Hence in circumstances where agreement amongst the equipment expert panel was not forthcoming through dialogue alone, the decision to progress each design requirement was taken by vote. All panel members were assigned an equally-weighted vote with a majority rule invoked when a unanimous consensus could not be reached.

In order to attain an acceptable standard it was inevitable that compromises were implemented by the equipment expert panel to amalgamate the diverse priorities and needs of all stakeholder groups. The major concession surrounded the true level of 'inclusion' achieved. Not all items of fitness equipment can, or will, be completely accessible to every person who has an impairment. Even with products designed to meet the inclusive design standard there will be users who will continue to experience barriers to access. The success of the standard was thus considered to be in pushing mainstream product design boundaries to accommodate an increased range of users. This important aspect of the standard's development is discussed at length in Chapter Eight.

Alongside choices on subject matter, the equipment expert panel's task of agreeing exact wording and language usage proved to be equally vital to achieving consensus. Although complicated and time-consuming, the consistent use of clearly defined and widely understood terminology was important in accurately conveying information. Subtle changes in punctuation or phrasing could shift emphasis onto a different aspect of a requirement in the standard or even change its meaning completely. Wording was favoured which avoided ambiguity and misinterpretation of intent, but that additionally facilitated multiple design options and the development of novel or unique solutions. Conventionally, a standard should be written in such a way that its provisions can be undertaken, and compliance shown, by its intended readers, who are typically manufacturers and suppliers rather than product end-users (BSI, 2005f). Occasionally, it was judged vital for consensus that information concerning the actions of fitness equipment end-users be incorporated into the inclusive design standard. In these cases criteria were presented in the form of “information to be supplied to the user” in order to be cognisant of equipment supplier needs. An example is the following requirement: “removable benches that are not fixed to the equipment must have a visual reference to ensure the correct bench alignment and position of the user when performing the primary exercise”. This specification assists users to relocate the bench correctly aiding safe performance of the exercise. Conformity with the requirement however, is retained within the control of the equipment supplier design staff applying the standard. On occasion the phrasing ‘shall be avoided’ was utilised in order to acknowledge that not all inclusive design requirements could be enforceable through the standard. In these cases the standard became more informative rather than prescriptive. A prime example concerns location of adjustments to avoid left or right hand bias. Congregating multiple adjustments centrally could cause confusion and leave insufficient space to access individual mechanisms on some products. Thus the design requirement in the standard pertaining to position of adjustments was set to read: “Left or right hand bias of adjustments shall be avoided when setting up the equipment. Adjustments shall be centrally located or duplicated to avoid bias.” BSI (2005f) suggest the subtle difference between “shall” and “should” terminology could also be used to achieve the same effect; “shall” indicates provisions which are mandatory whilst “should” is used to indicate that a provision is not mandatory but is recommended as good practice.

Successive working drafts of the inclusive design standard were reviewed by the equipment expert panel until, through compromise and carefully considered wording, consensus was reached. It was regarded that at this stage of development, the most appropriate technical content to balance and satisfy competing stakeholder needs had been achieved within the standard. Consequently the manuscript was sanctioned for circulation to participating stakeholders and other interested parties for a period of public comment.

6.2.4 Phase 4: Public Comment Period

It is expected that following the creation and approval of a document by a small panel or individual expert the draft is offered to the public for review and comment (CSA, undated). A public comment period enables a broader audience to view the document, ensuring transparency and acceptability of the resulting standard (BSI, 2005c). This stage in the development of a standard hence provides for due process by considering all views and allowing appeals (ASTM, undated b). In the case of drafts for development this enquiry stage may be omitted, but it is an obligatory stage of consensus-building for consortia standards (BSI, 2005b). Notably for consortia standards, public consultation affords a clear opportunity for stakeholders to verify that a particular standard is responsive to market requirements and is appropriate to their needs.

The inclusive design standard was released for a formal three-month public comment period from 1st October 2005 to 1st January 2006. All equipment supplier representatives participating in focus group sessions received a copy of the manuscript, as did 24 different disability organisations who had either helped with tester recruitment for the practical testing sessions or who had explicitly expressed an interest in assisting with development of the standard. Besides these organisational representatives, 15 disabled people with a range of impairments received copies of the standard. These individuals were selected to share in the consultation process based on their previous participation in practical testing sessions and/or their relevant knowledge and expertise. Focus group session number 7, held on 5th December 2005, was specifically dedicated to discussions on the content of the draft with designers and other non-design related organisational representatives. All additional parties were invited to comment on the drafted inclusive design standard though email or telephone communication with the author or indirectly and anonymously via the IFI office.

The public comment period successfully achieved its aim of gathering comments for the drafting committee and extending the standard's consensus.

Six responses were received via email or telephone outside of the focus group session, but undoubtedly the majority of feedback came from the equipment supplier event. Upon closure of the consultation period, all responses were collated and submitted to the equipment expert panel for consideration, to inform further decision-making and voting preferences by this committee. Examples of typical feedback and subsequent changes to requirements include:

Colour Contrast

Proposed Requirement for Colour Contrast – Seats:
"Colour contrast should be applied to all of the front edge of the seating surface. Where there is a backrest a portion of (a minimum of 5%) of the surface should utilise a primary contrast to the remainder of the seat."

Product Designer Feedback:
"A two-tone seat is very expensive to do practically. It is only possible on upholstered seats, not on moulded seats."

Final Requirement for Colour Contrast – Seats:
"Seat upholstery shall have colour contrast with the frame. This may mean that a number of combinations of coloured upholstery and frame will not be permitted."

Handles

Proposed Requirement for Seat Handle Proximity:
"Where fixed handles are fitted in proximity to the seat or bench they shall have a minimum distance of 45mm and a maximum distance of 60mm measured between the outside edge of the seat and the inside edge of the handle."

Product Designer Feedback:
"Handles by seats do not always run parallel to the seat for their entire length. They are often curved around towards the back of the seat where they are attached to the main framework. Is there a specific length they need to be between 45mm and 60mm?"

Final Requirement for Seat Handle Proximity:

"Where fixed handles are fitted in proximity to the seat or bench they shall have a minimum distance of 45mm and a maximum distance of 60mm measured between the outside edge of the seat and the inside edge of the handle for a minimum of 150mm of the handle length."

As well as facilitating feedback on the technical content of the standard, the public comment period provided an opportunity to respond directly to concerns expressed by consulted parties. Offering advice, interpreting requirements and allaying fears at this stage undeniably assisted with a more rapid completion of the final standard documentation. Alongside encouraging dialogue on technical content, an added benefit of the public comment period was in promoting awareness of the imminent release of the standard.

6.2.5 Phase 5: Approval

All feedback received from the public comment period was communicated with the drafting panel for review during the approval phase. Stakeholder comments on the inclusive design standard were presented to the equipment expert panel to be assessed and, where necessary, sanctioned. Observations were considered in turn and accepted or rejected for incorporation within the standard, utilising the prioritisation hierarchy presented in Table 6.2 to aid decision making when required. No substantial changes were necessary to the inclusive design manuscript as a result of feedback from the public comment period. For the most part stakeholder comments were accepted and encompassed directly within the standard. As an example, the requirement for colour contrast on seats was modified to include the option of single coloured seats so long as they provided clear colour contrast with the surrounding framework. This variation was made with the understanding that not all colour combinations of framework and upholstery would be permitted to meet the standard. The requirement for seat handle proximity was also modified in order to clarify that the specified distance requirements should apply for a minimum of

150mm of the length of the handles. Any items of stakeholder feedback rejected by the equipment expert panel at this stage were registered for consideration during a future revision of the standard.

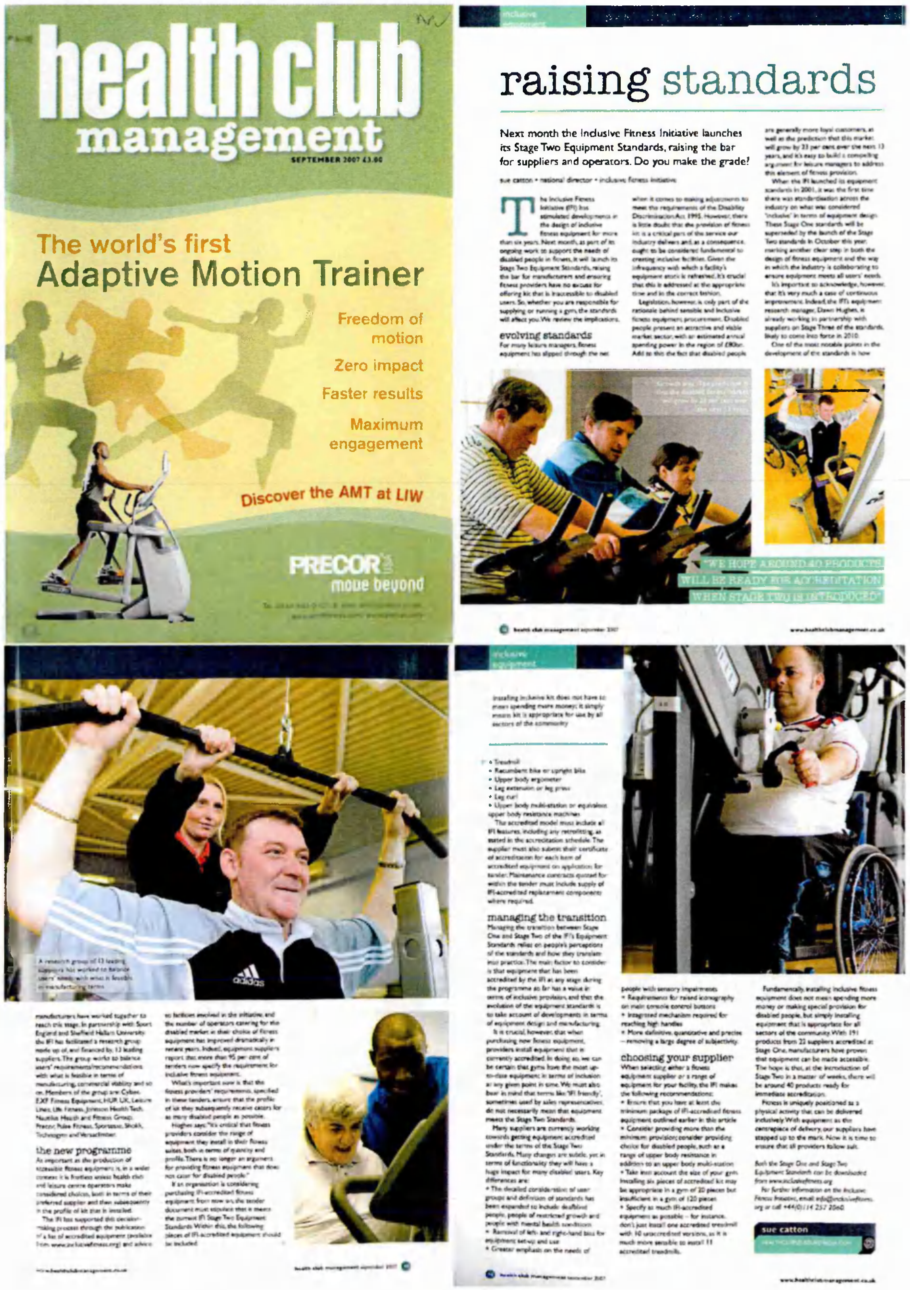
Once the equipment expert panel reached consensus on the content of the standard, it remained only for an editorial assessment to be made prior to publication. The final draft was inspected to ensure the text was clear, unambiguous and presented in the correct style. Cross-referencing checks were performed to ensure the provisions specified were not varied or undermined by any subsequent text (BSI, 2005e). Consistent use of terminology and symbols were additionally confirmed. Concluding practical trials were carried out by the author, in collaboration with a member of the equipment expert panel, on three different test products to validate the successful application of the standard. Final approval and endorsement to publish was then sought, and obtained, from the equipment expert panel. In the development processes practiced by national and international standards bodies the standard is normally forwarded at this stage to a parent committee for further consensus-building (ISO, 2003b). In the case of the inclusive design standard no parent committee existed and autonomy for publication therefore remained with the equipment expert panel.

6.2.6 Phase 6: Publication

Subsequent to receiving endorsement for publication the penultimate phase in the standard's development process was to formally issue the agreed text as a standard (ISO, 2003b). Consisting of the ten Parts outlined in section 6.2.4.3, the complete 110-page inclusive design standard was published under the title 'Inclusive Fitness Initiative Equipment Standard - Stage Two' (see Figure 6.10) on 1st May 2006. Two complete sections of the standard, Part 1 – General Requirements and Part 2 – Strength Equipment, are provided in Appendix I for illustration. The latter may be specifically compared with both Figure 6.3 and Appendix G to illustrate the increased breadth and complexity of requirements from the draft for development to the inclusive design standard as a result of the research. Initial dissemination of the inclusive design standard was limited exclusively to those supplier organisations participating in focus group sessions, after which it was made available as a free of charge download from the IFI website (www.inclusivefitness.org). The standard remains in this location as a public and openly available document which can be accessed by any interested party.

Figure 6.10: Inclusive Fitness Initiative Equipment Standard - Stage Two (front cover)

Alongside issuance of the manuscript, the publication phase intended to promote the standard through various channels to bring it to the attention of as wide an audience as possible (BSI, 2000). The inclusive design standard was publicised to the fitness industry through a series of four feature articles in Health Club Management magazine (see Figure 6.11) in the August 2005, December 2006, September 2007 and January 2008 editions. As an official publication of the Fitness Industry Association, Health Club Management is a leading periodical within the UK fitness industry having a circulation of approximately 9,000 (The Leisure Media Company, 2006). Targeted predominantly at club operators and fitness professionals, this publication is widely read and utilised for advertising purposes by fitness equipment supplier organisations. Announcements via this medium thus enabled those in the fitness equipment supply industry and equipment purchasers to be simultaneously informed of the inclusive design standard's publication. Promotion of the new standard was also made to the fitness industry via an item in Recreation Magazine (Easton, 2005b), and outside of the industry in the Inclusive Sport (EFDS, 2005), Forward (Spinal Injuries Association, 2006) and DDA Leisure Directory (Baker, 2006) publications.



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evolving standards

managing the transition

the new programme

choosing your supplier

sue catton

Figure 6.11: Awareness-raising article in Health Club Management periodical (September 2007, pgs 48-50)

Promotion within industry press was supported by word of mouth marketing of the inclusive design standard by members of the equipment expert panel and fitness equipment supplier representatives, as well as the wider IFI team. Unequivocally, however, the most extensive exposure for the standard was through its direct implementation within the IFI's equipment accreditation process. This formal product endorsement scheme is recognised within the industry to be the quality mark for inclusive fitness equipment provision. Since 1st October 2007 a significant element of achieving 'IFI Accredited Item' status has been the mandatory compliance with all aspects of the published inclusive design standard. The 17-month time lag between formal publication of the standard and the date of enforcement within the IFI equipment accreditation process was set to allow implementation time for equipment supplier design staff. Recognition of the inclusive design standard within the IFI's equipment accreditation process not only provided direct practical application of the research findings, it also proved highly influential in gaining wider recognition of the standard. The adoption of the inclusive design standard by both European and American national standards-setting bodies is discussed in Chapter Seven.

6.2.7 Phase 7: Review

Several factors may combine to render a standard out of date: technological evolution, new methods and materials, new quality and safety requirements or the development of original knowledge (ISO, 2003c). Standards thus need to be maintained, which is represented in the concluding standard development phase. The majority of standards undergo a process of periodic review to warrant them up-to-date and technically valid. The outcome of this process is normally confirmation, revision or withdrawal of a particular standard (ISO, 2003b). Although outside the remit of the current study, a five year periodic review cycle is suggested by the author for each Part of the inclusive design standard. As far as possible this programme should be synchronised to coincide with the scheduled review of the corresponding Part of the BS EN 957 fitness equipment safety standard (BSI, all dates). Reappraisals held in this format would enable the inclusive design standard to reflect any modifications made to the safety standard and avoid unintentional disparity between these two entities. From a product design team perspective this parallel approach would also be beneficial in only requiring a single iteration of design changes to comply with amendments to either or both standards.

6.3 Conclusion

Adoption of a well-structured and recognised standard development process was successful in formulating and issuing an inclusive design standard specifically for the commercial fitness equipment industry. The definitive content of the standard was achieved through operating under the formal 7-phase process advocated by BSI (2005c) and summarised in Table 6.1. Furthermore, adoption of this process enabled wide consensus to be achieved between equipment supplier and disability organisations. Subsequent to the formation of a multidisciplinary standards committee, an initial draft for development was released to offer a timely response to industrial demands for inclusive design guidance. This endeavour was based primarily on the professional knowledge and expertise of the assembled equipment expert panel members. A more authoritative version of the inclusive design standard evolved from this draft in conjunction with a preparatory document comprising consolidated user needs obtained through practical product testing. Successive drafts of the standard encompassed equipment supplier design and organisational imperatives which were identified through a series of focus group investigations. Information from existing data sources and supplementary practical product testing data were also used to augment the standard where necessary. The definitive content of the standard was determined by the equipment expert panel, who developed and implemented a prioritisation hierarchy to guide decision making and resolve inevitable conflicts in stakeholder requirements. This proved to be an effective strategy in enabling the committee to reach a satisfactory consensus. Wider consensus-building was achieved through a public comment period, before subsequent approval and publication of the final inclusive design standard by the equipment expert panel. Whilst the information contained within the standard cannot be exhaustive, the guidance is intended to indicate what constitutes reasonable, achievable provision in the inclusive design of commercial fitness equipment.

From initial drafting through to final publication and dissemination, the adopted process assisted in the appropriate application of technical expertise whilst ensuring wide consultation and negotiation with stakeholder groups. Alignment with an established standard development method has enabled user needs to be successfully negotiated with industrial participants, and in this respect has fulfilled research objective (4). A willingness to participate by those interested parties making up the major stakeholder groups made it possible for a wide range of needs to be incorporated and balanced within a single standard. The result is a comprehensive and moderately prescriptive inclusive design standard, available for use by equipment supplier design teams throughout the commercial fitness equipment industry.

The primary hypothesis guiding this thesis is that "producing a user-informed, consortium standard is an effective means to support designers in adopting inclusive design practices for commercial fitness equipment". With the standard now established, its effectiveness in supporting more inclusive design practices can consequently be considered. Chapter Seven assesses the value assigned by the commercial fitness equipment industry to the published inclusive design standard, and through case studies and questionnaire evaluation reports stakeholder feedback on the standard, illustrating its practical application by major equipment suppliers to their current fitness equipment designs.

Chapter Seven: Evaluating the Effectiveness of the Inclusive Design Standard

7.1 Introduction

This thesis' governing hypothesis is that "producing a user-informed, consortium standard is an effective means to support designers in adopting inclusive design practices for commercial fitness equipment". Following the formal process undertaken to develop and achieve consensus on the content of the inclusive design standard, and its publication and subsequent dissemination throughout the fitness equipment industry, the present chapter reports commercial responses to this new documentation, and its effectiveness as a tool to support more inclusive design practices. Two primary research methods were employed. Firstly, a series of case studies are presented, giving examples of actual product design changes resulting from the application of the inclusive design standard to commercially available fitness equipment. These studies illustrate both an uptake of the standard and also validate that the standard's availability has indeed impacted current design practices. The second research method involved analysis of qualitative data, gathered from product design teams via questionnaire, on their experiences of utilising the standard. Feedback from respondents is examined to identify trends and provide judgements on the effectiveness of the standard in supporting more inclusive design practices. Commentary on the wider significance and value of the inclusive design standard to the fitness industry is also provided through supplementary evidence from external organisations, including two national standards-setting bodies and an International Paralympic Committee (IPC) representative. In combination, this work provides evidence to fulfil research objective (5) by investigating the impact and effectiveness of the developed inclusive design standard on design practices within the fitness equipment industry.

7.2 Impact on Current Design Practice - Inclusive Product Developments

Incorporation within the IFI's formal product endorsement scheme has undoubtedly provided wide exposure for the inclusive design standard. The IFI's list of 'Accredited Items' represents the definitive guide to the inclusive fitness equipment available in the UK marketplace (NCPAD, 2006). Since 1st October 2007, compliance with the inclusive design standard (also known as the 'IFI Equipment Standard – Stage Two' within this context) has been a mandatory requirement to achieve the IFI's Accredited Item status. Eighteen months into this adoption period, on 1st April 2009, the number of IFI Accredited Items totalled 90 products, available across 14 different commercial equipment suppliers. Table 7.1 provides a breakdown of these items by generic product type, demonstrating the successful application of the inclusive design standard to a broad spectrum of equipment categories.

Table 7.1: 'IFI Accredited Items' known to comply fully with the inclusive design standard (as at 1st April 2009) by generic product type

Generic Product Type	Number of Compliant Products
Strength equipment – upper body	24
Strength equipment – lower body	21
Strength equipment – multistation	10
Upright cycle	6
Recumbent cycle	8
Upper body ergometer	4
Treadmill	8
Elliptical / crosstrainer	2
Balance training platform	1
Vibration training platform	2
Miscellaneous / Other	4
Total	**90**

As full conformity with the inclusive design standard has been established for every product, the case studies presented in this chapter are all extracted from this data source. Each case study has been selected to correspond with one of the five dominant themes identified by disabled users as being particularly problematic during practical product testing. Inclusive product features, implemented as a direct consequence of the requirements set out in the inclusive design standard, thus address the following themes:

- Adjustment mechanisms difficult to use - Case Study A
- Need for clear and easy access onto equipment - Case Study B
- Unsuitable resistance increments and ranges of movement - Case Study C
- Overly complex programming - Case Study D
- Lack of multi-sensory information on user-product interfaces - Case Study E.

For each of the five themes identified, reduced levels of design exclusion are described after implementation of the inclusive design standard, with products shown before and after for comparative purposes. Case study methods are advantageous for displaying such like-for-like product comparisons and for conveying examples of good practice. The case studies that follow have been selected as those considered to best illustrate a variety of components and product types which are shown to be indicative of the breadth of application of the inclusive design standard. No bias is intended through the presentation of particular products or representation of certain supplier organisations. The author is aware of commercial sensitivities in this area and wishes to stress that other equipment manufacturers, not specifically profiled here, have also made significant advances in increasing the accessibility of their products.

The case studies have been extracted during conformity testing conducted by the author, following new product developments completed by equipment supplier design staff as a consequence of the inclusive design standard. The product imagery in this chapter has been gathered during this conformity testing and from industry literature collected at the Leisure Industry Week (LIW) 2008 and Club Industry '08 trade events. All products can be purchased in the UK and have associated marketing information available within the public domain. Disclosed product details are therefore not knowingly contravening any pre-existing supplier confidentiality arrangements.

<u>CASE STUDY A</u>: *Ease of use of adjustment mechanisms*

The use of adjustment mechanisms was reported as a significant and widespread source of design exclusion by many disabled users during practical testing. Many mechanisms were commonly described as being difficult to locate and complicated, laborious or awkward to use. The requirements of the inclusive design standard hence focused on making adjustment mechanisms more obvious to find and easier to use. One method for achieving this was to promote the use of contrasting colours to make adjustment mechanisms easier to identify. Figure 7.1 shows the impact of a simple colour change on an otherwise identical weight selection pin to make it more noticeable. Perhaps the most obvious beneficiaries of this increased contrast differential are people with visual impairments. However, more subtle benefits include easier communication with users with learning difficulties or when using sign language to provide instruction to deaf individuals (signing "pull yellow" is more straightforward than having to fully describe the form and location of the adjustment when its position cannot easily be seen). Fitness equipment designers following the inclusive design standard are widely implementing the principle of colour coding throughout a product, by specifying all adjustment mechanisms to be an identical colour. This visually coded set-up provides clear and consistent information on the location of adjustment mechanisms. Incurring minimal cost, this highly practicable approach encourages independent usage, offering benefits to both disabled and non-disabled product users.

Before... **After...**

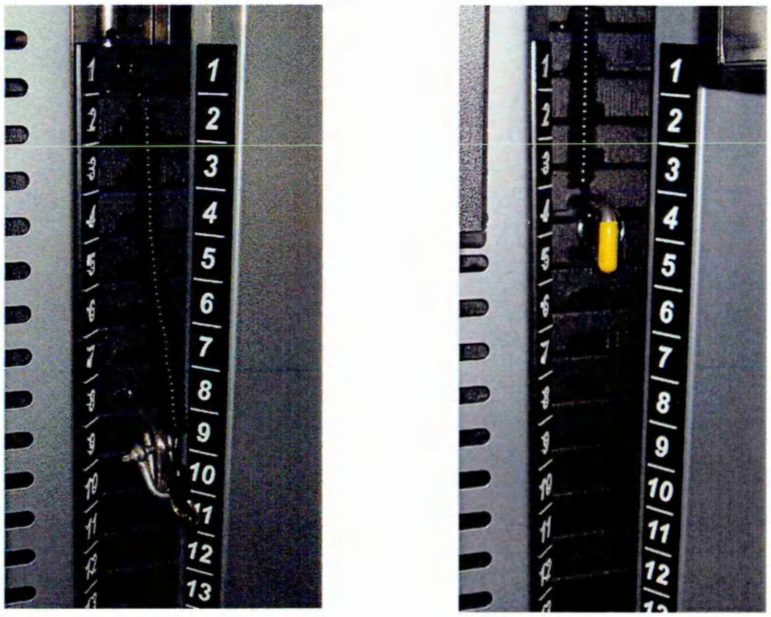


Figure 7.1: Increased colour contrast on weight selection pin

Reducing the design exclusion emanating from adjustment mechanisms offers a good example of the progressive nature of the inclusive design standard and its mandatory requirements. Conditions surrounding colour contrast were introduced into the draft for development version of the standard to assist users with locating adjustment mechanisms. However, the final version of the inclusive design standard also went on to consider the more complex physical interactions required to make adjustments, demonstrating a clear intention from members of the equipment expert panel to include a wider range of disabled individuals. The inclusive design standard contains specific criterion surrounding the ease of manipulation of activation pins, the ability to perform such operations with only a single hand and the avoidance of right- and left-hand bias. In combination these requirements should assist users with limited hand function or reduced finger dexterity as well as those with asymmetric strength, including amputees, individuals who have had stroke and people with arthritis. These considerations may also be equally important for people who use mobility devices, including crutches and walking sticks, where one side of the body is used to gain support from the aid whilst the other is free to make adjustments to the equipment.

Figure 7.2 evidences a weight adjustment pin re-designed to comply with the inclusive design standard. The redesigned ring-pull shape does not require the use of a pinch-grip for operation, making it less demanding of fine motor control and finger dexterity to grasp and manipulate. Figure 7.3 illustrates a similar re-design of a pulley unit adjustment pin in order to more easily facilitate one handed use. Compared to the original design, the D-shaped handle offers a larger gripping area and a more natural hand orientation for the vertical movements required of this adjustment. In combination these features provide greater purchase and hence control to move the pulley unit into the desired vertical position. As less physical strength is required, the adjustment is now achievable using only one hand.

Before... **After...**

Figure 7.2: Ring-pull shaped weight selection pin for ease of grasp and manipulation

Before... **After...**

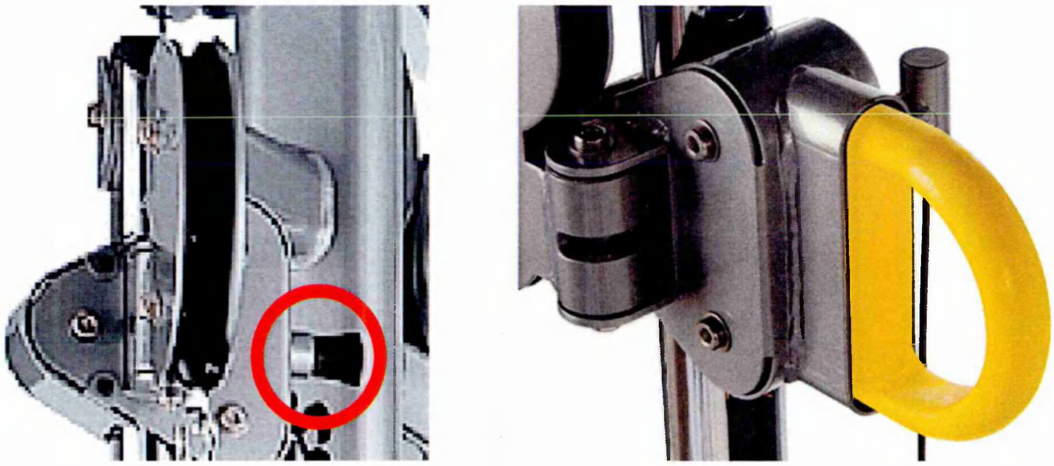


Figure 7.3: Pulley unit adjustment pin re-designed to facilitate one handed use

Of equal importance to the shape of actuation pins and one-handed use, is the avoidance of left- and right- hand bias when positioning adjustment mechanisms. Traditional seat height adjustment mechanisms on exercise cycles usually require the use of two hands; a retaining pin is pulled and held to release with one hand, whilst the saddle is simultaneously lifted or lowered with the other hand. To conform to the inclusive design standard's requirements for one-handed use without bias, a gas-assisted seat adjustment was introduced onto the upright cycle shown in Figure 7.4(a). Different seat height positions are set by pressing the large lever embedded centrally into the rear of the saddle, making this adjustment easily achievable using only one hand and without left- or right- sided bias. Similarly, the short original adjustment lever has been lengthened and wrapped around the front and both sides of the seating arrangement on the recumbent cycle in Figure 7.4(b). In this configuration the adjustment can be activated with either hand, from multiple positions along its length, thus offering choice and flexibility to all users. Both of these seat height adjustment mechanisms were designed to meet identical clauses in the inclusive design standard, suggesting the generic requirements contained within the standard can be applied with equal success to different product types.

Before... After...

(a) Upright cycle

Before... After...

(b) Recumbent cycle

Figure 7.4: Centrally located seat height adjustment mechanisms to avoid left- or right- hand bias

CASE STUDY B: Need for clear and easy access onto equipment

A lack of clear and easy access onto equipment was described as problematic by many disabled users during practical product testing. Although apparent across several impairment profiles, perhaps the most conspicuous and prohibitive issue was the inability of wheelchair users to access upper body equipment due to being obstructed by fixed, immovable seating arrangements. As required by the inclusive design standard, Figure 7.5 illustrates the replacement of a non-removable seat with one that can be swung out of position, leaving an unobstructed floor space for those wishing to exercise from a wheelchair. For safety, the seat is physically locked when in either the standard or removed exercise positions. Significantly, a twist-and-lock plunger, that can be lifted and retained in an open position whilst the seat is moved into the desired location, was specified for the removable seat mechanism. Whilst removing the seat with only one hand, wheelchair users can then use their other hand to either brace themselves against the forces involved in moving the seat, or can make small manoeuvring adjustments to the position of their wheelchair. Through the re-design of this product to meet the inclusive design standard's removable seat criteria, the almost complete exclusion of wheelchair users from accessing this product has been remedied.

Before... **After...**

Figure 7.5: Addition of removable seat to facilitate wheelchair access

<u>CASE STUDY C</u>: *Unsuitable resistance increments and ranges of movement*

Cognitive walkthrough was commonly utilised by the equipment expert panel when setting the technical content of the inclusive design standard. Considering the product through the eyes of its users was intended to give greater regard to the product as a whole, as opposed to only considering interactions with individual components. This technique proved particularly important in identifying how individual design changes may have secondary, and otherwise unforeseen, impact on the remaining product. The addition of a removable seat to the equipment in Figure 7.5 undeniably facilitated wheelchair access. However, it concurrently exacerbated the difficulties some users experienced in reaching the high handle in order to perform the exercise correctly. Several small and seated users reported design exclusion caused by handles being positioned too high to reach during practical product testing. Historically on lat pulldown equipment, such as that shown in Figure 7.5, users would stand up to reach and draw down the high handle into the exercise start position, whilst at the same time manoeuvring their legs around and below the knee pad to sit on the seat. For wheelchair users with limited or no leg function, this range of movement is practically impossible to achieve. To remedy this considerable barrier to exercise, an additional pulley and increased cable length were added to create a pivoting adjustment mechanism capable of lowering the height of the handle, as shown in Figure 7.6. The inclusion of an additional adjustment initially caused a certain degree of concern due to the increased product complexity. The decision to implement the new adjustment was followed however, as it was deemed to benefit the majority of users. Any detrimental effects of increased product complexity could also be partially offset through colour coding of adjustment mechanisms for ease of set up, as illustrated by Case Study A.

In order to enable the maximum number of users to benefit from the new lowered handle position, the inclusive design standard also demands that the seat be height adjustable to accommodate users of all heights, and also sufficiently wide for those preferring to transfer from a wheelchair to exercise. Additionally, the instructions for use must be located so as to be at eye-level when in a seated position. Whilst instigated predominantly with a bias towards accommodating the needs of wheelchair users, these developments will benefit a much wider range of individuals. For example, users of differing heights and those with limited shoulder flexibility should be able to achieve a correct, non-stressed start position more easily beneath the exercise handle due to the product's increased adjustability. Obese users are offered more comfort and support by the wider seat, whilst those with visual impairments are assisted by the reduced reading distance to the instructional panel. Many of these features offer equally positive benefits to non-disabled users, reflecting the true ethos of inclusive design.

Before... After...

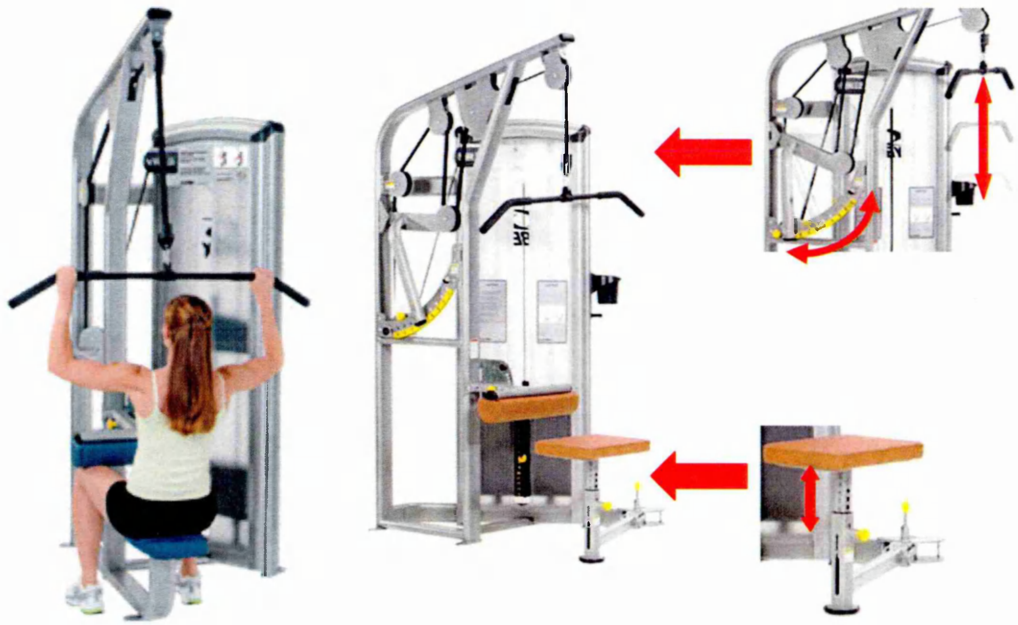


Figure 7.6: Lowering of high handle to accommodate small and seated users

What is evident from this case study is the need to adhere to the inclusive design standard in its entirety. Failing to consider product usage holistically, and applying only selected criteria from the standard, will not necessarily enhance usability or reduce design exclusion. Consequential effects of design changes, positive and negative, must be appreciated and the cognitive walkthrough technique employed by the equipment expert panel appears to offer a satisfactory approach to these considerations.

<u>CASE STUDY D</u>: Overly complex programming

Programming and set up of electronic control consoles was cited as a major source of design exclusion by users when attempting to access cardiovascular fitness equipment. Criticised for being complicated and confusing, these consoles were hard to navigate and often difficult and unclear to read. Improving this situation was hence a major focus for the inclusive design standard, as demonstrated by the two re-designed consoles in Figures 7.7 and 7.8. In Figure 7.7, the upper section of the console offers only the five main functions required to operate the equipment successfully. This grouping of controls for simplicity is intended to make programming less intimidating for users unfamiliar with the product. More advanced programme options, for those requiring them, are available in the lower section of the console. To enable users to better distinguish button locations, all button diameters have been enlarged and an increased colour differential applied between the button edges and surrounding background material. These developments will offer particular assistance to visually impaired users and also those with limited dexterity or tremor by providing larger activation areas to target. All main controls are labelled clearly to indicate their function in large, sans-serif and colour contrasting text. To maximise the legibility of this text, these descriptive labels are presented in sentence case font, rather than block capital letters. Pictorial icons have also been introduced as button descriptors, a feature helpful for non-English speaking users and which also supports usage by people with learning difficulties. Most of these icons have been provided in a raised, tactile format to enable blind users to navigate around the main control buttons through touch alone.

Before... **After...**

Figure 7.7: Console re-design to increase button clarity and simplify programming

As in Case Study A, the effective use of colour to enhance product usage has also been considered during console re-designs. To definitively distinguish the primary and most frequently used controls, the inclusive design standard stipulates that green is utilised on all 'Start' and 'Quick Start' functions. This selection is intended to align with the colour scheme commonly associated with 'go' in a standard traffic light system. Correspondingly, the use of red is dictated on 'Stop' controls to provide increased recognition of this important safety feature. The console in Figure 7.8 additionally illustrates the colour coding of control pairs that offer related functionality. Identical colours indicate a natural coupling, as shown by the yellow background to both the increase and decrease load buttons on the lower right hand side of the console. To avoid confusion different colours are implemented for each set of paired controls, demonstrated by the use of orange, as opposed to yellow, on the increase and decrease incline buttons on the lower left hand side of the console. These colour schemes are aimed at increasing button recognition and reducing the reliance on language alone for basic programming. Such changes will be advantageous for visually impaired users who are unable to see or decipher the written word but who are able to discriminate between colours. These developments should also reduce design exclusion and encourage more independent product usage by non-English speaking users and those with learning difficulties, for whom language comprehension is a significant barrier to access. All enrichments made to consoles to comply with the inclusive design standard are intended to improve usability and generally simplify product programming. Whilst benefits for specific impairment groups are highlighted, these modifications should have a positive impact on all users, whether impaired or not.

Before... **After...**

Figure 7.8: Console re-design utilising colour for identification of major functions

<u>CASE STUDY E</u>: Lack of multi-sensory information on user-product interfaces

Case Study A describes the progressive nature of the inclusive design standard's technical requirements during its evolution from a draft for development to a more comprehensive manuscript. The intention of the current case study is to show the parallel advancement in the ability of equipment supplier design staff to respond to the requirements of the standard. Nowhere is this phenomenon more apparent than in response to the lack of multisensory information on user-product interfaces. Consoles on cardiovascular equipment were heavily criticised during practical product testing for an absence of tactile information to aid visually-impaired, blind and deaf-blind users. Thus, both the draft for development and the inclusive design standard dictate the provision of tactile information on console buttons to assist users with reduced vision. In order to comply with the draft for development standard it was only necessary to identify the location of the button by touch, through either a raised icon contained within the button or through provision of tactile information to delineate the button edge. In Figure 7.9 the left hand image illustrates one solution employed to obtain compliance with this requirement. Solid circular sections were removed from the plastic overlay where they align with the button activation areas located beneath. These openings can easily be felt by touch and do not impede access to the button. The real importance of this example is in illustrating the necessary use of a retrofit solution at this stage, demonstrating a practical limitation when initially introducing inclusive design into the commercial setting. Few UK equipment supplier representatives were able to influence the very first stages of overseas new product development by non-UK product design teams, where true integration of inclusive requirements could be achieved most cost-effectively. Exposure to the new inclusive design standard often occurred at an inopportune point in product design cycles for changes to be effectively incorporated. Issues particularly arose when new product design was started from the premise of re-designing an established, non-inclusive product rather than from a completely new concept. Additionally, some initial resistance to investing in expensive re-tooling costs was apparent from those who had not participated directly with the development of the inclusive design standard. Their concerns centred mainly on risk and return on investment until inclusive products had been confirmed as being commercially viable in the UK marketplace. Due to overseas manufacture much of the retrofitting work was carried out by UK technical support departments, with costs typically being absorbed by the UK-based supplier organisation and not the parent company.

More stringent requirements surrounding the provision of tactile information on consoles were mandated in the inclusive design standard compared to the draft for development. As the citation in section 6.2.3.5 of Chapter Six clearly shows, the inclusive design standard requires both the location and functionality of the button to be identifiable through touch alone. Quantitative parameters are specified for the dimensions of this more comprehensive tactile offering, along with conditions on its durability and fitness for purpose. Figure 7.9 evidences the console subsequently developed by the same equipment supplier design staff to comply with the inclusive design standard. Tactile information on this console is provided through an embossing process applied onto the main console overlay. This is an integrated approach, manifesting from the requirements of the inclusive design standard being considered at the very beginning of the design process. The result is clearly defined, resilient tactile iconography which successfully allows visually impaired users to navigate around the console through touch.

Before... **After...**

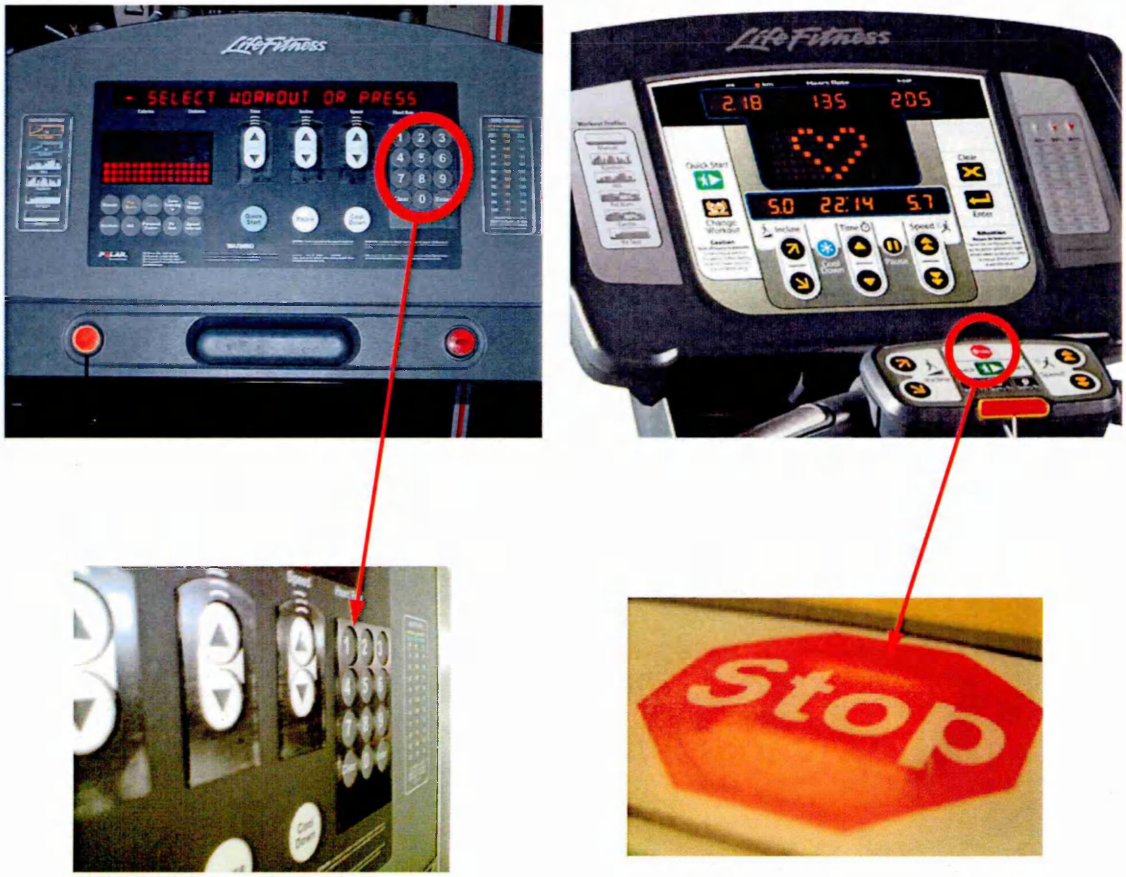


Figure 7.9: Progression from retrofit to integrated solution for provision of tactile information on consoles

7.3 Effectiveness of the Inclusive Design Standard in Supporting Change

Case Studies A to E and Table 7.1 are indicative of the successful application of the inclusive design standard to a range of different product types and use by multiple supplier design teams. This strongly suggests that the technical content of the standard is appropriate and that it has been effectively disseminated throughout the fitness equipment industry. With the suitability of the standard established, and more inclusive design principles evidently adopted into product development processes, it becomes necessary to examine the value of the standard in supporting product designers with this transition. Insight into this area was gained through the development of a questionnaire to elicit primary data from equipment supplier design teams. Consisting of five open-ended questions, of which four incorporated an additional closed Yes/No question, this survey aimed to collect opinions and experiences of utilising the standard to achieve more inclusive design practices. A completely open text field was offered at the end of the document for respondents to provide any additional or generic comments as desired. For reference, Appendix J contains a copy of the questionnaire and its associated covering letter along with examples of completed surveys.

The questionnaire was issued to all supplier organisations having one or more products on the IFI's Accredited Items list on 1st April 2009. This represents an 18-month implementation period between incorporation of the inclusive design standard into the IFI's product endorsement scheme and distribution of the questionnaire. Taking differing design cycles into account, this timeframe was deemed as the minimum necessary to gain sufficient breadth of application of the standard in order to collect comprehensive and truly informed feedback. Multiple requests for responses were made to six larger supplier organisations, where it was known that several departments had separately implemented significant parts of the standard (for example, where separate strength and cardiovascular product design teams existed). From the 20 questionnaires issued to product designers across 14 organisations, 12 were received back from 8 different companies, equating to a 60% questionnaire response rate. Of these, 2 questionnaires explicitly listed multiple names in the respondent information section, suggesting these replies offered combined feedback from several members of these product design teams. The total data set thus encompasses the views of 15 individuals. Data analysis consisted of tallying Yes/No responses to closed questions and performing a content analysis on the qualitative narrative provided for each open-ended question across all questionnaires. Significant findings and emerging themes which evidence the value of the inclusive design standard to the equipment supplier design staff providing comment are presented below. For reasons of confidentiality, all extracts are quoted anonymously with specific references to products or geographical locations removed.

According to submission information, the data set comprises opinions from individuals typically describing their job roles as: Director of New Products, Product Manager, Brand Manager, Managing Director, Product Designer and Senior Mechanical Engineer. The questionnaire commenced by directly asking these respondents as to whether they had found the inclusive design standard useful in incorporating inclusive principles into the design of their equipment. An overwhelming majority, eleven out of twelve replies, responded positively with justifications for their decisions including:

"The 'IFI Equipment Standards - Stage Two' determines measurable, exact engineering values to be met by the design. So the principles to be followed are translated to Engineering language."

(Program / Brand Manager)

"Good set up. Presents standards in a way that allows designers to use information, e.g. distances, clearances."

(Director of Quality)

"The stage two standard is useful because it puts quantitative limits on design variables that I personally may not have thought of when formulating a design. For example, I might design the seat height on a machine to accommodate the height of a 5th percentile female, but not necessarily a less-than able-bodied person."

(Mechanical Engineer)

"This standard shows new principles, tools, and design approach for a more ergonomic construction."

(Program / Brand Manager)

"Gives set standards to design against and helps reduce the amount of research needed to be conducted personally into inclusivity."

(Product Designer)

"The standard was very helpful in describing what features were important for enabling people with various disabilities to use the equipment. It gave detailed guidelines on how to use color contrast, graphics size and tactile feedback for aiding sight-impaired users, step-on height guidelines and motion lock-out for aiding mobility or balance-impaired users, and centralized location of electronic controls for users with loss of capability on one side of their body."

(Director of New Products)

These quotations advocate the usefulness of the inclusive design standard in providing quantitative design parameters. On the whole equipment supplier design staff welcomed this type of data as informative and constructive, enabling them to integrate the information into their current design processes. The single negative response received concerning the usefulness of the standard reported that some of these parameters were too restrictive and obliged all product designers to develop the same solution. Whilst not wishing to undermine the validity of this response, and acknowledging that standards should indeed enable the implementation of innovative solutions, the author believes this comment may be in reference to a specific issue, known to have occurred on a single product, and is not a wider reflection of the standard in its entirety. This respondent, along with all others, goes on to commit to a continuing use of the standard:

"I believe the design intent that the standard promotes is worthwhile and I will continue to keep these principles in mind for future designs."

(Mechanical Engineer)

"As a company we are currently taking into account Stage 2 standards in the design of our new CV range."

(Product Designer)

Ongoing commitment to wider use of the inclusive design standard was also shown by three respondents who reported application of its technical content to products not explicitly intended as their 'inclusive' range:

"We now include many of the principles into the R&D stage of all equipment as we find the Inclusive designs are also suitable for the units we produce for the Medical and Active Ageing markets."

(UK/European Managing Director)

"Some indication contained in the standards may bring benefits to users not considered 'disabled' and it's possible that we will implement related features on 'standard' fitness equipment."

(Product Manager)

"We will try and use (some if not all) the information contained within the standards right across our product range."

(UK/European Managing Director)

The phenomenon of applying the standard more widely than originally anticipated offers an additional level of value to the fitness equipment industry. One significant reason attributed to this success was the efficacy of the inclusive design standard as an aid to communication. Ease of communication across organisations was one of the original tenets for the production of a design standard, and equipment supplier design staff feedback suggests that the dissemination of inclusive design information via a written medium is indeed proving beneficial. As one respondent explains:

"I am the UK IFI representative, not directly part of the [non-UK based] *design team. However I am responsible for either ensuring IFI products are designed in the* [non-UK location] *to meet the needs of the IFI, or to modify machines locally within the UK to meet IFI requirements. The Stage 2 standards have allowed me to identify in detail the needs of the IFI standards. The more detailed the standard the less room for interpretation. Where the products have had to be*

modified locally in the UK (albeit as a short term measure) the document has been (and continues to be) very useful as a working document to carry out the changes."

(UK Service Manager)

Similarly, a product designer based outside of the UK confirms the importance of the inclusive design standard in providing guidance to those operating at a geographical distance:

"Considering that the product development of our equipment is done in either [non-UK location A] *or in* [non-UK location B] *where the IFI standard is much less known, it was crucial that the IFI equipment standard was developed to provide us with the necessary direction."*

(International Strength Product Manager)

These quotations support the general lack of knowledge about how to design to include people with impairments, believed to have previously pervaded the industry. Anecdotal descriptions of this situation, uncovered initially during literature searches and also focus group work with equipment supplier representatives, were reinforced by all twelve questionnaire responses. As the following extracts substantiate, inclusive design was rarely practised, if at all, in the industry before exposure to the draft for development (Stage One), published as part of the current research:

"Other than Stage 1 information, no inclusive design was undertaken- no previous information was available."

(UK Service Manager)

"We didn't specifically address inclusive design. We have always worked to make our equipment usable by a wide range of people. We do this by building prototype equipment and surveying users with various heights, ages and body weight. All of these surveys are typically done with non-impaired individuals."

(Director of New Products)

Subsequent to working with the inclusive design standard, and gaining familiarity with its content, fitness equipment design staff were questioned about the in-house development of comparable inclusive design data. Their feedback suggests it is highly unlikely that this type of documentation would have been developed within individual supplier organisations, due predominantly to time and resource constraints:

"Without the information supplied as part of the IFI process, the resources within the UK office would seriously inhibit such a standard or anything approaching it from being developed."

(UK Service Manager)

"It is difficult to say, but I think it would have been quite a lengthy process and not easily undertaken."

(Director of New Products)

"It would not have been pursued."

(Director of Quality)

"Hundreds of man hours would be required. Most likely we would not have investigated this field with our own resources."

(Group Product Manager)

A lack of confidence from respondents in their ability to produce comprehensive inclusive design information within acceptable commercial parameters, points towards the need for a collaborative approach to generating this type of data. The consortium model employed, with an independent body stimulating and leading the research, appears to have been effective in overcoming inertia, enabling a comprehensive and accepted standard to be developed. Provision of the inclusive design standard has thus been instrumental in both prompting and supporting participating product designers, and the organisations within which they work, in their transition towards more inclusive design practices. It is encouraging that, given their starting points, of the seven respondents who had received customer feedback on products compliant with the inclusive design standard, all reported this to be positive:

"The IFI requirements work so more people can use the equipment."

(Director of Quality)

"In general we have got positive feedback on the highlighted, color contrasted adjustments/settings/markings on our products."

(Program / Brand Manager)

"The IFI keypad - the colour coding, raised iconography etc are all easier to access. However, some users simply prefer the look of this keypad to the standard one!"

(General Manager)

"Very positive, as mentioned earlier we have found that many features fit other markets. For example we now use the IFI overlay on our console as a standard for all consoles."

(Vice President Operations)

"Our sales team has also received requests from [non-UK based] *customers for the IFI-compliant step-up platform that we created for* [our inclusive product]. *We didn't anticipate this, as we assumed it would only be useful for mobility-impaired individuals. So, this feature has been even more inclusive than we anticipated!"*

(Director of New Products)

These latter examples indicate the success of the standard in increasing user satisfaction with fitness equipment through reductions in design exclusion. In many cases it seems that inclusive features are making a transition to replace those on 'standard' versions of the product. In this respect the inclusive design standard offers a foundation for widespread integration of inclusivity, where considering the needs of disabled people is regarded as a genuine asset by equipment supplier design staff. This undoubtedly has positive implications for the long term applicability of the research findings, as one respondent summarises:

"The most important legacy of the standard is to continue to encourage design teams to 'think inclusive' when designing products, not to consider it as an add-on for a special version of the machine, but for the 'standard' machine to become the 'inclusive' machine. Within [our company], *I have noticed over the years of being involved with the IFI standards how less changes are required to the standard product to meet the IFI needs - this is a positive indication that the 'inclusive needs' are becoming a 'design need' rather than an afterthought."*

(UK Service Manager)

The increasingly seamless integration of inclusive principles into fitness equipment design processes suggests that there is a basis for the enduring application of inclusive design within the fitness industry.

7.4 Endorsement by National Standards Organisations

The cause for long term adoption of inclusive design practices within the fitness equipment industry has been further progressed by the formal recognition of the inclusive design standard by two separate national standards-setting bodies as well as other external organisations. These endorsements provide the standard with additional merit, important for engendering confidence amongst product design teams that the standard can support them in adopting inclusive design practices. Crucially, these external acknowledgements also present opportunities to further embed usage of the standard within the industry, through its wider dissemination and long term sustainability.

7.4.1 British Standards Institution, Committee for European Normalisation and International Organization for Standardization

As a direct consequence of the development of the inclusive design standard, the European Standards Committee for Stationary Training Equipment (Technical Committee CEN/TC 136 “Sports, playground and other recreational equipment”) has made a formal recognition of the importance of inclusion. The European standard under this group’s jurisdiction, EN 957, governs the safety of fitness equipment throughout the 28 CEN member countries, comprising the European Union nations along with Norway, Switzerland and Iceland. Each member nation adopts the EN 957 safety standard through its national standards body. Hence, CEN (EN) standards are automatically adopted in the UK by the British Standards Institution and published as British (BS EN) Standards. Part 1 of the EN 957 standard outlines a classification system by which equipment should be marked as to its suitability and accuracy for Commercial (Class S) or Home (Class H) usage. A revision to this Part in 2005 saw the introduction of a completely new class, Inclusive use (Class I), which recognises equipment “provided for inclusive use for people with special needs e.g. visual, hearing, physical or learning disabilities” (BSI, 2005h, pg 8). The draft for development (Stage One) publication was referenced as the only formal national guidance document available for achieving this usage classification. The intention is that subsequent revisions will be updated to cite the more comprehensive inclusive design standard (Stage Two). Whilst currently positioned as an addendum to the main body of the EN 957 standard, the integration of appropriate inclusive requirements will also be advocated during periodic reviews of each of its specific Parts. Before making normative reference within a standard to a publication outside the direct control of a national standards body, BSI demand that the publication has wide acceptance and authoritative status (BSI, 2005f). In 2005, EN 957 was reproduced faithfully as the content of the new international standard for fitness equipment ISO 20957: 2005 (ISO, 2005). Hence, recognition of the inclusive design standard within the international standards development community, as well as providing for its longevity, corroborates and expands the level of consensus achieved.

7.4.2 American Society for Testing and Materials

With the USA boasting the largest fitness market in the world, and a significant number of fitness equipment supplier organisations being American owned and based, it was considered imperative to penetrate this marketplace and encourage uptake of the inclusive design standard. There are many organisations that comprise the USA's standardisation system, of which one of the largest and most diverse is the American Society for Testing and Materials (ASTM) International. Through collaboration with ASTM's Technical Committee F08.30 on Fitness Products, a task group was initiated by this standards developing organisation in April 2008 to further develop standards for inclusive fitness equipment design. The focus of this sub-committee (WK19803: Inclusive Fitness Equipment Design) is to "facilitate access to mainstream fitness equipment to a wider range of the population across all abilities" (Rauworth, 2008, pg 1). The technical content of the inclusive design standard formed a considerable proportion of the first and all subsequent working drafts of the standard considered by this group, supported by information from Beneficial Designs Inc. (www.beneficialdesigns.com), an American organisation funded through the National Institute on Disability and Rehabilitation Research to develop universal design guidelines for fitness equipment. One of the committee's founder members summarises the value of the inclusive design standard to the ASTM national standards body:

> *"The IFI has already made significant progress with the development of fitness standards for the UK and this acquired experience will be a substantial advantage in formulating a uniform set of standards for inclusive, accessible fitness equipment in the US and UK and a positive step towards creating global standards."*
>
> (Rauworth, 2008, pg 1)

A harmonised inclusive design standard across Europe and the USA, two of the most dominant and established fitness markets in the world, will offer a strong platform from which to progress to a unified worldwide standard. The global economy has raised the stakes in standards development, with the American National Standards Institute (2005) believing the impetus to develop globally accepted standards to be greater now than ever before. Standards reflecting an international perspective need to be in place to maximise exporting potential, as using one standard across multiple markets is more efficient and less expensive, making trade significantly easier and simpler (BSI, 2002; ASTM, undated a). With fitness equipment supplier organisations typically selling product ranges transcontinentally, a common inclusive design standard will undoubtedly support their overseas commerce and export. As an associated benefit, this economy of scale may also offer fitness equipment supplier organisations further justification of any investment required to achieve compliance with the standard. ASTM's recognition of the inclusive design standard has therefore not only increased the credibility and level of consensus surrounding the standard's technical content, it has also provided impetus and solid foundation from which to pursue a single global standard.

7.5 Endorsement by Non-Standards Related Organisations

Alongside endorsement by national standard setting bodies, the provision of recommendations regarding the needs of disabled people in relation to fitness equipment design, as contained within the inclusive design standard, have also received recognition from organisations outside of the standards development community. This phenomenon of external acknowledgement has provided assistance to further embed the principles of inclusive design into the fitness equipment industry.

7.5.1 UK Trade & Investment and International Paralympic Committee

The inclusive design standard has received recognition from UK Trade & Investment (UKTI). Hosted to coincide with the 2008 Olympic and Paralympic Games held in Beijing, China, UKTI's '12 for 2012: Winning With Innovation' competition focused on acknowledging products, services or materials that have, or will, revolutionise sport. The IFI was selected as one of only twelve award winners for "the impact made in the design of inclusive fitness equipment, underpinned by robust standards developed in consultation with disabled people and the commercial fitness industry" (Catton, 2008). Other winners included Speedo, for their revolutionary LZR Racer high performance swimsuits, and civil engineers Arup for the spectacular Olympic 'Bird Nest' stadium. During his keynote address at the awards reception, Sir Philip Craven, President of the International Paralympic Committee, endorsed the work of the IFI in solving the challenges disabled athletes, at all levels, encounter in accessing fitness equipment:

> *"The IFI Equipment Standards have provided the designers of fitness equipment throughout the world with long overdue advice and guidance in developing products that are accessible and useable by everyone. The IFI is to be congratulated on this award that recognises eight years of innovation and development in this field providing both physical activity and strength and conditioning opportunities for all people."*

Sir Philip Craven, President of the International Paralympic Committee,
August 2008
(reported in Catton, 2008, pg 1)

7.5.2 Local Authorities and Leisure Trusts

The use of standards is advocated by BSI as being particularly beneficial within public sector procurement contracts (BSI, 2005b). UK Government-funded Local Authorities and Leisure Trusts have necessarily been quick to consider, and react to, the legislative implications of the Disability Discrimination Act (HMSO, 1995; TSO 2005) on their gyms and fitness facilities. Feedback from supplier representative questionnaires suggests that up to 90% of all new fitness equipment tenders emanating from this sector now specify a requirement for IFI Accredited products. Additionally, a number of capital funders, including Sport Scotland and the Sports Council for Northern Ireland, have placed specific conditions on the installation of inclusive fitness equipment as part of their funding criteria. As Easton (2009) explains:

> *"IFI Accreditation – currently based on the IFI Equipment Standards Stage 2 – is the only formal frame of reference for purchasers and users to determine whether equipment is designed inclusively."*
>
> (Easton, 2009, pg 42)

In this capacity the inclusive design standard is not only supporting equipment supplier design staff in adopting more inclusive practices, it is also enabling equipment purchasers to easily assess and compare the inclusivity of different products. The stipulation by Local Authority and Leisure Trust procurement teams, and capital funding providers, for products which meet the inclusive design standard demonstrates their implicit regard for the standard and its usefulness.

7.6 Conclusion

Subsequent to the development, publication and dissemination of the inclusive design standard for commercial fitness equipment, this chapter has explored the industry response to this newly available resource. In order to gather evidence to indicate the validity of the thesis' governing hypothesis, and to address research objective (5), two primary data collection methods were employed to study the value of the standard to equipment supplier design staff striving to achieve more inclusive product designs. Firstly, a series of case studies evidence the application of the standard in its entirety to a range of different product types, all now commercially available in the UK market. All of the products showcased are from equipment supplier design teams who have implemented design changes to evolve their mainstream products into more accessible and inclusive versions. Each case study directly addresses one of the five dominant themes identified by disabled users during practical product testing as being particularly problematic and inaccessible. Reduced levels of design exclusion are indicated in all of these important areas, along with the progressive nature of the standard's content as it advanced from a draft for development into its final, more comprehensive, format. The imperative that product designers implement the standard in its entirety, to ensure the needs of all impairment groups are considered cohesively, is additionally highlighted through the case study examples. Necessary design compromises to accommodate different, and often opposing, user needs are outlined. Finally, the case studies offer evidence of the increasing ability of equipment supplier design staff to fully integrate the requirements of the inclusive design standard into their products, rather than produce retrofit solutions.

With physical product design changes established as a result of the existence of the inclusive design standard, a questionnaire-based data collection method was implemented to source primary data from fitness equipment design staff. This approach was utilised to assess the effectiveness of the inclusive design standard in supporting the product developments evidenced by the case studies. Positive responses were overwhelmingly achieved to questions concerning the usefulness of the standard in adopting more inclusive design practices. The specific, quantifiable and measurable parameters offered by the standard were particularly welcomed by product designers, as was the existence of the standard as a general aid to interdepartmental communication. Respondents indicated an increasing transition of inclusive features onto 'standard' versions of products, suggesting a value for the standard beyond that originally anticipated. Numerous commitments were received for the continuing use of the standard in future design work.

Supplier representatives confirmed a previous lack of inclusive design data and suggested that, due to resource limitations, it was unlikely that information similar to that contained within the standard would be developed by their individual organisations. Given the mounting evidence from the industry of its transition towards more inclusive design practices, it could be concluded that the inclusive design standard has removed at least one barrier to the production of more inclusive products. Development of the standard via a consortium approach appears to have provided sufficient impetus to supplier organisations to overcome existing inertia towards this endeavour. Once developed, recognition of the inclusive design standard by the IFI, both European and American national standards setting bodies, UKTI, a leading International Paralympic Committee representative, and numerous Local Authority and Leisure Trust procurement teams, further substantiates the widespread value of the standard throughout the industry.

This chapter thus provides evidence to support this thesis' governing hypothesis that producing a user-informed, consortium standard is an effective means to support designers in adopting inclusive design practices for commercial fitness equipment. Overall the findings tend to suggest that production of a standard is indeed an effective means to support equipment supplier designer staff and the organisations within which they work, as well as the wider industry, in the adoption of more inclusive practices. Chapter Eight now goes on to consolidate the main findings of the work and evaluate the extent to which the original research aims have been met.

Chapter Eight: General Discussion and Conclusions

8.1 Introduction

The overarching aim of this thesis was to test the hypothesis that: "Producing a user-informed, consortium standard is an effective means to support designers in adopting inclusive design practices for commercial fitness equipment". To examine the validity of the hypothesis, five research objectives were set in order to both develop the inclusive design standard and also to assess its subsequent effectiveness:

(1) To corroborate a perceived lack of inclusive design information relevant to commercial fitness equipment. To be achieved through an examination of literature and other pertinent sources.

(2) To identify the foremost sources of design exclusion for a sample of disabled users with a range of impairments. To be achieved through the practical testing of fitness equipment.

(3) To explore barriers, opportunities and imperatives for the development of an inclusive design standard with representatives from a sample of commercial fitness equipment suppliers. To be achieved through a series of focus group sessions.

(4) To create an inclusive design standard with consensus on its technical content across all consulted parties. To be achieved through independent expert panel guidance to equitably synthesise data collected from users and suppliers.

(5) To investigate the impact and effectiveness of the developed inclusive design standard on design practices within the fitness equipment industry. To be achieved through case study and survey methods.

Fulfilment of these research objectives required a systematic set of studies to be designed to obtain information from the three major stakeholder groups deemed critical to influencing and achieving inclusive equipment design. This chapter explores the extent to which the research has achieved each of the five original objectives and evaluates the process by which they were realised. Pertinent findings and conclusions are drawn together and presented under the three key topic areas of; efficacy of the research approach, influences on the effectiveness of the inclusive design standard and sustaining inclusive design practices within the industry.

8.2 Efficacy of the Research Approach

In order to consider the validity and representativeness of the research findings, it is necessary to firstly examine the efficacy of the research approach in terms of developing the standard, its impact on inclusive design practices and any limitations of the research methodology selected.

8.2.1 Development of the Inclusive Design Standard

The research aimed to secure an in-depth understanding of the complex subject area of inclusive fitness equipment design through involving those participants considered to have the greatest relevant knowledge. This multiple stakeholder involvement was also used to achieve the widest possible level of consensus, a necessity for successful standardisation (BSI, 2005e). Through predominantly inductive and qualitative research techniques, it has been possible to independently gather pertinent data from user, fitness equipment supplier and health and fitness professionals stakeholder groups.

Through practical testing of commercially available fitness equipment, a sample of disabled users have been able to give a clear understanding of existing problems and indicate potential directions for improvement, which as Dong *et* *al.* (2002) outline is a necessary basis for countering design exclusion. Some of the issues identified with existing fitness equipment through this testing were comparable to the limited examples of design exclusion found in the initial literature review, for example authors such as McGough (1999) who identified the existence of confusing adjustments and hard to read controls, and Bennett (1999) who reported the need for seats that could be removed to make space for wheelchair users. However, as a result of considering a wide range of both users and product types beyond those previously considered by the fitness industry, new issues were also detected. Testing of current equipment has ensured the pertinence of the data set, from which it has been possible to draw conclusions which have successfully formed the basis for the technical content of the inclusive design standard. Practical product testing by disabled users has therefore been found to be a valid and useful research method for uncovering design exclusion and promoting the need for inclusive design within the fitness equipment industry.

Commercial issues and challenges for equipment supplier design staff were successfully identified through the focus group technique adopted with the equipment supplier stakeholder group. Dominant concerns including cost, suppression of creativity and the need to design for absolutely everybody were found, which were similar to those reported by Keates *et al.* (2000) from a cross-industry workshop investigating industry attitudes to inclusive design. The similarity of these findings indicates the validity of the research approach and also the potentially universal nature of these concerns. In the research with fitness equipment supplier representatives, the focus group approach was particularly valuable in maintaining equity across commercially competing organisations and as a forum for discussion, as one focus group participant noted:

> *"The R&D meetings themselves have been a great opportunity for developing the IFI standards together with a joint goal. They allowed decisions to be made as a group and concerns could be easily voiced and discussed efficiently."*

(Focus group participant, Session 7, 5th December 2005)

Utilising an expert panel has been a successful research approach to synthesise user and equipment supplier data sets and publish a technical standard with wide consensus. In essence, this data collection from numerous sources and subsequent analysis of the same problem from multiple independent viewpoints, is an approach which should increase the validity and objectivity of the results obtained (McQueen and Knussen, 2002). The case study and questionnaire research methods utilised have also been effective in gathering evidence with which to consider the adoption of more inclusive product design practices from the fitness industry. Thus with the research methodology employed, it has been possible to develop a user-informed, industry consortium standard and investigate its subsequent effectiveness, although this approach is not entirely without limitations.

8.2.2 Limitations of the Research Methodology

It is acknowledged that a number of limitations exist within the selected research methodology and methods, particularly with regard to efficacy of sampling, statistical determinability and objectivity of participant feedback. Due to the magnitude and diversity of the populations involved, the research necessarily drew upon sampling methods and consequently the validity of the findings will be dependent upon the representativeness of the sample selected with reference to the wider population. One main sampling limitation surrounded recruitment of participants which was impeded in some cases by lack of access to, and availability of, suitable research subjects. For the user stakeholder group, the sheer scale and heterogeneity of the disability population meant that achieving a wholly representative sample was impossible. Whilst the available population of equipment supplier design staff was more restricted in terms of size and variability, widespread recruitment of these specialists for involvement in the study was made problematic due to organisational structures, geographical distances and competing organisational priorities. For the equipment expert panel, participant recruitment was mainly limited by a restricted population of individuals with relevant knowledge and expertise in the field from which to sample. Not being able to access a wider audience for feedback within each of these stakeholder groups may therefore have affected the ability to reliably extrapolate the results to wider populations.

A lack of clear statistical determinability within the user, equipment supplier and health and fitness professionals stakeholder groups led to the adoption of research techniques which were essentially qualitative and ethnographic in nature. Banister *et al.* (1994, pg 2) describe qualitative approaches as "the interpretative study of a specified issue or problem in which the researcher is central to the sense that is made". In order to minimise researcher bias and increase the study's objectivity, an independent and multidisciplinary panel of experts reviewed the data from user testing and focus group sessions, and a reciprocal period of public comment for the user and equipment supplier stakeholder groups was implemented. Whilst this approach was intended to increase the validity of the conclusions drawn, it will not compensate for any underlying bias present in the raw data collected. Authors such as French and Swain (2004) and Eisma *et al.* (2004) suggest that disabled and older people are often reluctant to complain or criticise products and that it is not uncommon for users to mistakenly perceive failures in design as failures in their own capability. Responses from disabled users during practical product testing may therefore have been unintentionally skewed towards more positive feedback resulting in under-reporting of barriers to access. Similarly, a need to maintain or enhance commercial reputations may have led supplier representatives to withhold negative information during focus group sessions and other forms of industry feedback. This tendency towards an overly positive outlook may have been further compounded by the development of a close working relationship between the researcher and equipment supplier representatives throughout the course of the study, potentially lessening the true objectivity of the feedback received. Perhaps most apparent in the equipment supplier design staff feedback, collected via questionnaire in the latter stages of the research, this influence on the validity and objectivity of the data collected could have been lessened through the use of an independent, external party to administer the questionnaire and analyse the results.

8.2.3 Impact on Inclusive Design Practices

Implementation of the inclusive design standard by numerous independent equipment supplier organisations, and within 'live' commercial design environments, provides credibility and validity for the research findings. Industrial feedback, via case study data and questionnaire responses, has demonstrated that through use of the standard, equipment supplier design staff have overcome inertia to inclusive developments to create more accessible mainstream products, a transitional concept which is illustrated in Figure 8.1. Due to the influence of external factors such as the health, social and legislative drivers which were outlined in Chapter Two, the specific magnitude and exclusivity of this transition as a direct result of the research is indeterminable. However, the evidence provided by the cases studies and questionnaire feedback does suggest a significant movement from inaccessible to more accessible and inclusive design practices, increasingly taking equipment provision for disabled people from rehabilitation and physiotherapy arenas into the mainstream fitness environment.

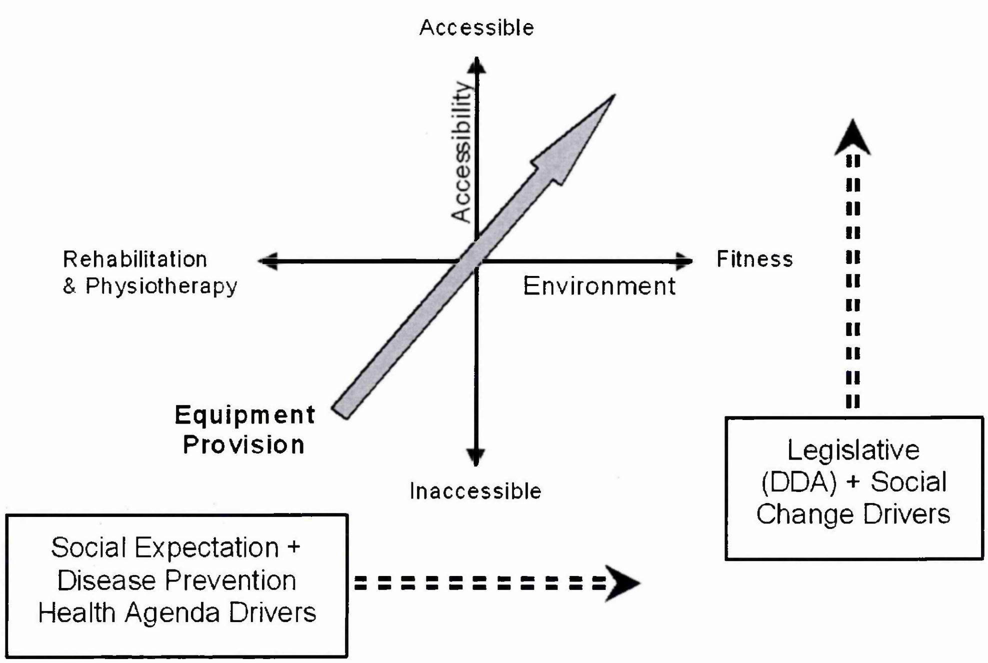
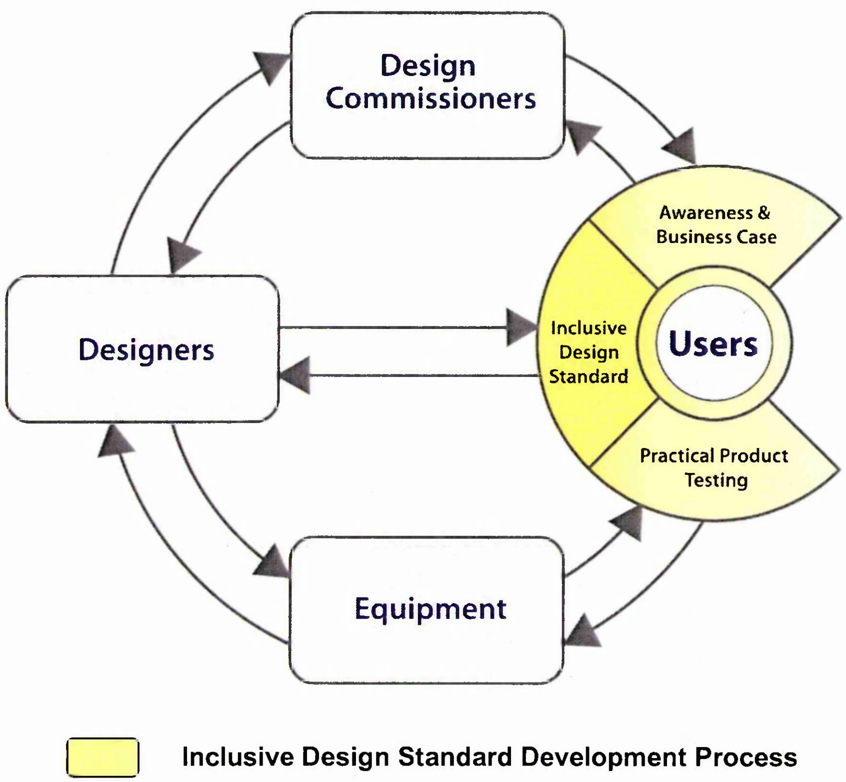


Figure 8.1: Fitness industry transition towards accessible mainstream equipment

The inclusive design standard has been effective in supporting the widespread practical implementation of inclusive design, since it has allowed:

- **Multiple stakeholder involvement** – the ability to draw on and consolidate diverse expertise and raise widespread awareness of inclusive design
- **Industry specific technical data** – the provision of product-specific inclusive design knowledge for the fitness industry, focussing only on relevant technical information
- **Efficient use of resources** – the efficient dissemination of information, simultaneously reaching multiple supplier organisations and design teams
- **Effective communication** – the facilitation of effective communication within multi-disciplinary design teams and the organisations within which they work, through the use of common terminology and formal documentation
- **Respect for commercial sensitivities** - the equitable sharing of commercial information in a confidential setting, maintaining individual intellectual property rights
- **Product designer creativity** – the use of performance based requirements to allow equipment supplier design staff creativity and product differentiation
- **Cost minimisation** – the consideration of inclusive design early in the design process to minimise costs
- **Informed decision making** – the availability of practical and specific information for supplier organisations to assess the business case for implementing inclusive design.

Many of the positive impacts achieved by the inclusive design standard have centred around addressing knowledge and communication issues. Returning to the initial knowledge and communication gap model identified for the fitness equipment industry in Figure 5.4, the inclusive design standard and its development process have contributed towards filling the observed voids, as indicated in Figure 8.2. The standard itself has provided equipment supplier design staff with relevant technical data and knowledge about the design needs of a range of disabled users, explicitly for the products they design. This has contributed to filling the gap between equipment designers and potential users of their products. Practical product testing during the standard's development process created a situation for disabled users, otherwise unlikely to do so, to interact with a wide range of fitness equipment. Data capture concerning these interactions has narrowed the gap between disabled users and equipment. The process of consultation with equipment supplier design staff and also non-design related organisational representatives during the development of the standard, has enabled misunderstandings surrounding inclusive design to be rectified and business case information about the disabled population to be conveyed. In this respect, the knowledge gap has been addressed between those managing and commissioning design and equipment users.



Source: Adapted from Keates and Clarkson, 2003a, pg 77-78

Figure 8.2: Impact of the inclusive design standard on the knowledge and communication gap model for the fitness industry

In addition to addressing knowledge and communication issues, the inclusive design standard and its development process have had wider outcomes at several levels:

Disabled People – For the first time disabled people have been given a voice in the fitness equipment design process, as the excerpt from an unsolicited email to the author from a user following one of the practical test sessions shows:

> *"Just to let you know that I thought the testing of the gym equipment yesterday was a very worthwhile experience for me. After some years of frustration I felt that someone was at last taking notice of my requirements."*
>
> (Visually-impaired tester, 28th November 2003)

The result of disabled user input has been to increase consideration of their needs in the design of fitness equipment, initiating a transition in equipment provision from rehabilitation and physiotherapy environments to the fitness suite environment, as Figure 8.1 illustrates.

Equipment Supplier Design Staff – Providing a technical resource has facilitated a new approach for product design teams within the fitness industry, resulting in increased awareness, aptitude and uptake of inclusive design. Dissemination of relevant information, developed in conjunction with industry experts, has given equipment supplier design staff confidence to address this discipline. The performance based requirements of the standard have eliminated the need for medicalised terminology, reducing the fear factor for design teams associated with the seemingly complicated and unfamiliar world of disability. Additional to providing a commonality of language for all involved, documented design standards have proved invaluable in allowing UK-based organisations to communicate effectively with their overseas design departments. Supplier organisations who outsource their detailed design work to freelance designers or design consultancies have utilised the standard as part of their formal product specification to these organisations. As a fixed metric the standards are thus employable throughout the design process to aid decision-making and as a measure of success in final testing and evaluation.

It can be seen from the results of the standard's implementation that the inclusive design standard has still allowed individual creativity for design teams within equipment supplier organisations. This has provided experiential evidence to product designers that the standard feeds predominantly into the functional requirements of a product rather than its form. Once given basic technical data, equipment supplier design staff have in essence followed their own established product development processes to produce inclusive equipment. Competent and conscientious practitioners have also begun to transition inclusive design information into a wide range of their other product designs.

Equipment Supplier Organisations – The inclusive design standard has allowed equipment supplier organisations access to market research and data on consumers which it is unlikely would otherwise have been sought. This information has had a notable impact at an organisational level, as illustrated by the following supplier quote:

> *"The IFI has been a very enjoyable scheme as it has enabled [Supplier A] to think about things in a completely different way. It is one of the few times that a very significant user group has had the opportunity to influence the commercial approach both locally and globally of the organisation."*

(Focus group participant, Session 9, 9th October 2008)

Specifically, the standard has supported the business case for inclusive design through raising awareness, encouraging consideration of the commercial potential of the disability market and offering the ability to judge the cost of manufacturing more inclusive products. Compliance with an independent and recognised standard within the industry has offered supplier organisations a unique selling point and marketing power, helping them to sell their inclusive products and to increase return on investment in inclusive design. Through the embodiment of new knowledge, the uptake of the inclusive design standard has enabled the realisation of new product designs, as well as provoking changes in organisational culture towards the inclusion of disabled people in the fitness industry.

Fitness Facilities – Increased availability of inclusive products in the marketplace has provided facility operators with a greater variety of equipment purchase options, resulting in them being better able to attract disabled members and to capitalise on this previously untapped population. Those responsible for procurement have considered compliance with the inclusive design standard when issuing and awarding tenders for new equipment provision, in order to take advantage of potential commercial benefits, to provide easily demonstrable evidence of their willingness to include the disabled market, and also to meet their duties under the Disability Discrimination Act (HMSO, 1995; TSO, 2005).

Fitness Industry – Exposure to the inclusive design standard has resulted in the development of new products and their associated target markets within the UK and international fitness industries. As well as driving current provision forward, this technical information has also allowed equipment supplier organisations to respond strategically to changing market needs and population demographics. In addressing the area of inclusive design, the industry has been able to demonstrate a collective corporate social responsibility and participate in an industry-wide initiative towards meeting the needs of disabled people. Compliance with the inclusive design standard in order to achieve accreditation under the IFI's product endorsement scheme has also contributed to the professionalism and regulation of the industry. Specifically the standard has provided a transparent, fair and repeatable process on which the IFI has been able to independently base its equipment accreditations.

International Standards Development Community – Provision of a technical standard in this new field has raised awareness of inclusive design and offered experiential knowledge of developing inclusive design standards to other standards-setting bodies. The inclusive design standard's content is contributing directly to international standards development in both Europe (CEN) and the USA (ASTM). As well as offering new knowledge on the inclusive design needs of disabled users, safety aspects of the inclusive design standard have particularly achieved direct crossover into the mainstream fitness equipment safety standard. The extract below, taken from prEN 957: 6 (CEN, in press), outlines requirements surrounding the application of multiple logos onto treadmill belts to ensure their visibility whenever the belt is in motion, reducing the risk of inadvertently stepping onto a moving surface:

> *"5.11 Running surface: Permanent marking in a contrasting colour is required on the running surface to determine if the belt is either moving or stationary. At least one marking shall be visible from the top view in any position of the running surface. The marking shall have a minimum dimension of 150 mm × 50 mm and a maximum dimension of 450 mm × 100 mm. Between two markings a minimum space of the size of one marking shall be provided."*

(CEN, in press, pg 10)

This criterion has been sourced from the inclusive design standard, where it was introduced as a risk reduction measure to assist visually-impaired users. Incorporation within the mainstream safety standard indicates direct knowledge transfer, with this initially inclusive requirement now considered to be of benefit to all users, disabled or otherwise.

Inclusive Design Community – Fitness equipment design represents a new area of investigation for the inclusive design community, with the standard making a contribution to knowledge and experiential learning on the topic. The specific technical inclusive design data may have relevance for additional products, but perhaps more importantly has engaged a greater number of design professionals with inclusive design. In transforming initially negative perceptions of this discipline, the cultural shift and new product designs achieved as a result of the development of the standard offer examples of good practice to further the wider cause of inclusive design.

Society – Standards make an impact on society at large (BSI, 2002), a phenomenon which arguably could be demonstrated in two distinct ways for the inclusive design standard. Firstly, as a result of developing the standard the social consequences of design have been increasingly recognised by representatives from the fitness equipment industry. Secondly, the increasing availability of products designed to meet the standard has created a new, more accessible environment for disabled people to exercise in mainstream fitness facilities. Schleien *et al.* (2003) define the concept of inclusion as a three stage process; physical integration, functional inclusion and social inclusion, whereby legislation against discrimination leads to the removal of barriers to successful functioning, both of which are precursors to the full social acceptance of disabled people. By enabling disabled people's participation in mainstream facilities through the provision of inclusively designed equipment, functional barriers have been removed, which according to Schleien *et al.* (2003) should support further social change and inclusion.

8.3 Influences on the Effectiveness of the Inclusive Design Standard

Based on the needs identified by disabled users during practical product testing and subsequently encapsulated in the inclusive design standard, case study and questionnaire feedback suggests that equipment supplier design teams have adopted more inclusive practices. Measurement of the actual level of inclusion achieved by these products is beyond the scope of the current work, although newly designed features along with limited user feedback reported by supplier representatives, suggest that access for disabled users has been improved. The effectiveness of the standard and the ultimate level of inclusivity that could be practicably achieved were however influenced by a number of factors which are summarised in Figure 8.3, and which operate at user, product designer and organisational levels. These key issues effectively put a design ceiling on the inclusivity of fitness products and the adoption of inclusive design within the fitness equipment industry.

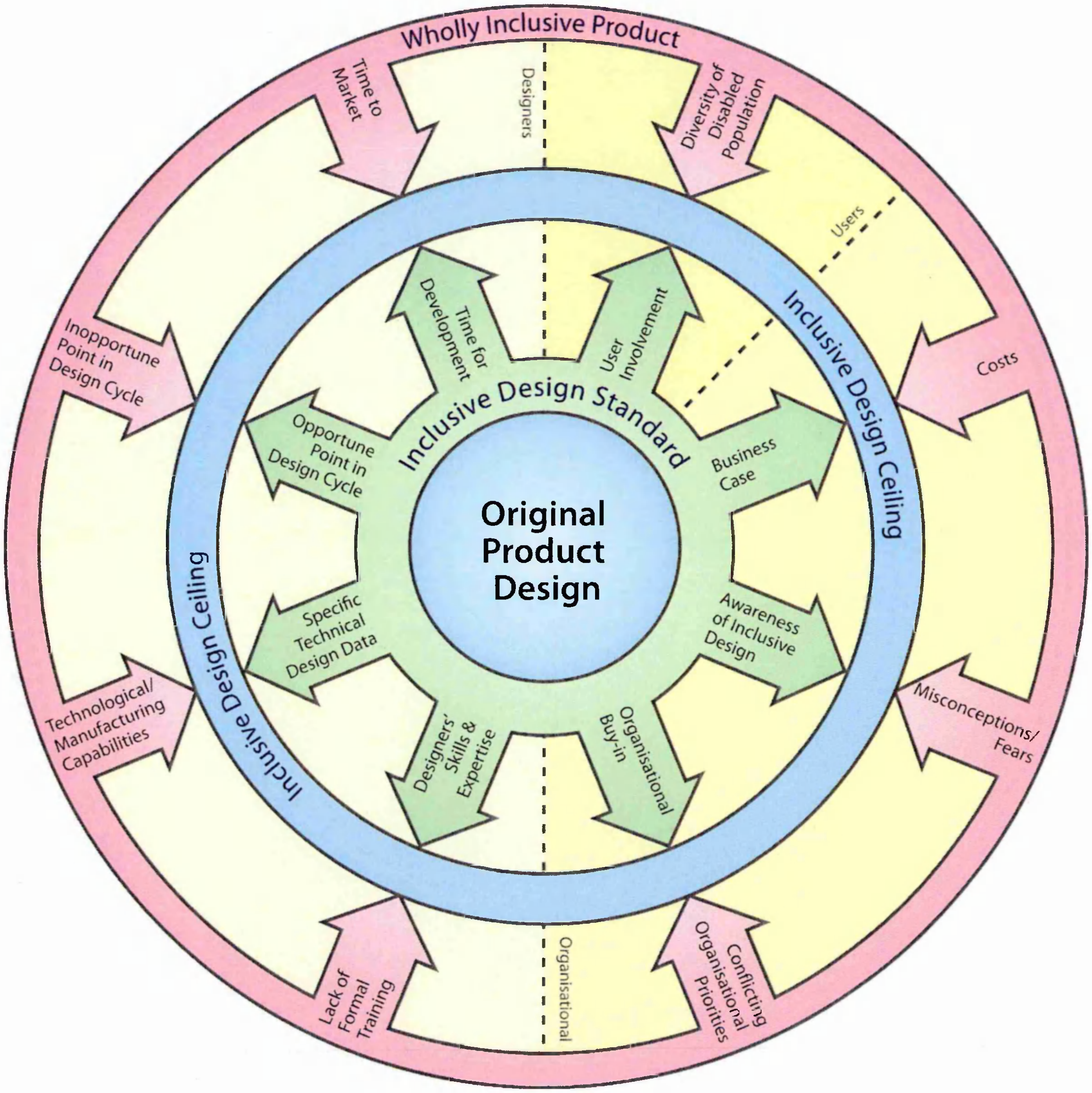


Figure 8.3: Key influences on the effectiveness of the inclusive design standard

8.3.1 Diversity of the Disability Population

Publication of the inclusive design standard and involvement of disabled users has increased access for a range of impairment groups beyond those previously considered by the fitness equipment industry. The inclusive design standard could not however provide exhaustive advice and cover every conceivable product type and user combination. As Holmes (2002, pg 13) identified "establishing absolute guidelines for such a diverse market is difficult". As Figure 8.3 shows, due to the limitless variability within the disabled population not all impairment groups could be fully catered for, with the available user sample, conflicting user requirements and lack of information on certain groups all having an influence.

A wholly representative sample of users was impossible to achieve in practice due to variables including, but not confined to, the numerous types of disability, severity of impairment, prevalence, age range and time living with disability. Absence of a clear definition of disability, and issues surrounding classification of impairment and self disclosure also made statistical analysis, categorisation and selection of users difficult. Ultimately, these factors will have limited the impairment groups represented in the inclusive design standard and consequently therefore, those primarily considered by equipment supplier design staff. Black (2006) argues that since the object of design research is rarely to produce statistically valid data, the focus of recruitment for user research should be on gathering insights from a diverse group of potential users. Following Black's (2006) rationale, the current research ensured that at the highest level, the major groups of physical, sensory and cognitive impairment were incorporated in a series of cross-sectional studies in order to include a broad coverage of user requirements.

Generalisations obtained from the sample of users were filtered by each member of the equipment expert panel, using their knowledge and experience of the topic, in order to increase the validity of the findings. In considering the data, it was clear that the panel would need to negotiate and compromise in order to achieve consensus and ensure industrial uptake of the standard. As Ekberg (undated) found in other industry case studies, an inherent difficulty of inclusive design was that a feature of a product which was advantageous to one user group may be the opposite for another user group, thus it would be almost impossible for an equipment designer to develop a product that would be all things to all people. The task of the equipment expert panel was thus to decide on the level of compromise that was acceptable. This proved a valuable exercise as the research was able to develop a hierarchy for prioritisation and decision-making in these situations based upon health and safety or risk management, commercial viability, level of inclusivity, availability of design data and test methods for compliance. With inclusive design rarely being 'design for all' in the sense that one product meets the needs of the whole population (BSI, 2005a), the standard attempted to maximise the number of people accommodated through provision of requirements across multiple product types, rather than focussing on a single item. Previous attempts to include disabled people in fitness equipment design failed as only wheelchair users and selected strength products were considered. Whilst not achieving complete inclusivity, this research has successfully extended the range of impairment groups and products addressed by the fitness equipment industry, bringing associated benefits to a more diverse population of disabled users.

8.3.2 Implementation Issues for Product Designers

Evidence from the equipment supplier design staff questionnaires and case study data indicated that production of the standard was an effective means to support product designers' implementation of more inclusive practices. This data suggests that the standard has made a number of beneficial impacts, however as Figure 8.3 illustrates, there were also several factors contributing to an identified inclusive design ceiling. Many of these issues surrounded a lack of appropriate timing, resources and expertise within the design process.

At the outset of the research, a lack of useful information regarding inclusive design within the fitness industry was identified, with equipment supplier design staff reporting little, if any, experience and no formal training within this field. Supplier representatives placed importance on gaining information about inclusive design quickly in order to shorten new product lead times to market, therefore the decision was taken to publish basic data in a draft for development (Stage One). In terms of strategies employed to meet the draft for development, on the whole equipment supplier design teams were tasked with retrofitting existing products, rather than implementing new integrated designs. This approach was dictated for reasons relating either to the design process itself, or alternatively, to wider organisational influences. Lack of resources, knowledge and confidence surrounding inclusive design and exposure to the standard at an inopportune point in the design cycle were all apparent, alongside general organisational inertia. However, as Bennett (1999, pg 32) reports, a retrofit approach is often not sufficient to accommodate disabled people: "the refitting of standard fitness equipment doesn't go far enough for some... Equipment of different basic construction has to be introduced into the fitness club to make exercise accessible to these people". In contrast, Petrick (2002, pg 4) identifies this as a beneficial approach, as "modifying existing equipment will be faster and cheaper than waiting for the new machines, and will allow more clubs to provide services to more people". The draft for development and associated retrofitting approach were always intended as short term solutions, with the primary aim of educating and raising awareness of inclusive design across the fitness equipment industry. The equipment supplier design teams' response to the draft for development represented the inclusive modifications that were reasonable to achieve with the requirement of a short lead time to market, rather than achieving more widespread product changes which would be addressed by the inclusive design standard (Stage Two).

As a consequence of the increased level of awareness achieved by the draft for development, equipment supplier design staff were better placed to respond to the requirements of the inclusive design standard and to build on the lessons learned. The inclusive design standard offered access to more comprehensive and specific technical data relating to the needs of disabled users for utilisation within product design. Alongside provision of more complete information, involving equipment supplier design staff in the development of the standard ensured that they were more engaged with the process and were thus able to progress their knowledge, skills and expertise surrounding inclusive design. The longer lead-in time associated with the inclusive design standard compared to its earlier counterpart, gave greater product development time, allowing design teams the potential to work on products that were at an appropriate point in the design cycle for the most effective implementation of the standard's requirements. For those equipment supplier design staff able to utilise the standard to impact in the earliest stages of new product development, more scope was available for making fundamental design changes and options for technological and manufacturing improvements were increased. In combination, these factors allowed equipment supplier design staff to adopt different strategies to meet the inclusive design standard, going beyond modified and retrofitted equipment to provide more integrated solutions.

Although products complying with the inclusive design standard have more built in features to meet the needs of disabled people than those adhering to the draft for development, or those available prior to the onset of the research, wholly inclusive products have yet to be achieved throughout the industry. BSI (2005a, pg 11) identify three basic strategies for implementing inclusive product development; firstly developing "add-on options", secondly upgrading relatively quickly through "superficial changes", or thirdly the complete "rethink of all design aspects" of existing products. Evidence suggests that equipment supplier design staff initially implementing strategies involving add-on options have now been able to progress, on the whole, beyond this basic approach towards the intermediate, and in some cases, towards the latter strategies identified by BSI (2005a). However, whilst progress has been made, design teams have not as yet been able to achieve seamless and complete integration of inclusive requirements. In many instances, inclusively designed products are presented as either a completely distinct and separate product range, or purchasers are offered a choice between a standard or inclusive version of the same base product, often with a price premium attached to the latter. One factor influencing this approach relates to the phasing of product design cycles. Due to the 5 to 10 year cycles typical of the fitness equipment industry, some organisations are still not in a suitable position for their design teams to integrate inclusive features from the outset of a completely new product development period. Nonetheless, the incremental product improvements which take place during these full design cycles, to effectively upgrade current models, have allowed equipment supplier design staff to add inclusive features. BSI (2005a, pg 37) suggest that this staged approach, "might go some way towards increasing accessibility, and be a desirable and less costly first step on the journey towards inclusivity", a strategy which has undoubtedly been witnessed within the fitness equipment industry. The gradual upgrading of products offers opportunities for ongoing integration and sustainability, as successful inclusive design features are retained and become increasingly incorporated into accepted base products. Responses from the equipment supplier design staff questionnaires indicate that this is beginning to occur within some organisations. Infusion of inclusive design information into mainstream product design over time should ensure that disabled peoples' needs become progressively embraced and integrated into the fitness equipment industry. Providing product designers with relevant and practical information in the form of the inclusive design standard has therefore been valuable for raising awareness and initiating more inclusive approaches to fitness equipment design. Despite implementation issues, equipment supplier design staff have progressively utilised more integrated strategies in order to raise the inclusive design ceiling previously apparent in the industry, which represents an important step towards the creation of truly inclusive fitness products.

8.3.3 Influence of Organisational Culture

When investigating levels of inclusivity, equipment supplier design staff should not be considered in isolation as their working practices and priorities are often dictated by the commercial organisations within which they operate. Such organisational factors influencing the effectiveness of the inclusive design standard are summarised in Figure 8.3, and centre mainly around knowledge of inclusive design, organisational buy-in and support, and business case issues all dictating the level of investment sanctioned in inclusive product developments.

Prior to the draft for development, no readily available inclusive design information existed specifically for the fitness equipment industry. Consequently, a general lack of awareness and understanding of the topic was apparent, as reported by both focus group participants and questionnaire feedback. Initial misconceptions around the belief that inclusive design meant designing for every conceivable user alongside concerns about cost and market appeal of inclusive products were noted. This lack of confidence and experience with inclusive design was also apparent with early attempts to implement the draft for development, evidenced by the retrofitting of existing products as a straightforward, relatively cost-effective and low risk approach requiring little long-term organisational commitment. However, the implementation of the draft for development was successful in raising awareness across all levels of the companies involved and in helping supplier representatives to begin to address issues and barriers, thus starting a process of organisational change towards more inclusive design practices. As one questionnaire respondent identified:

> *"Most of the issues have been internal, where designers or sales people questioned the need for some of the requirements. This was mainly due to not thinking about the disabled population as a whole and all the varied disabilities this encompasses. Once explained, this better understanding was then more widely accepted and the spirit of 'inclusivity' became an asset rather than a hindrance."*

(UK Service Manager)

Although the draft for development was instrumental in lifting the original inclusive design ceiling, it was not sufficiently detailed or comprehensive to bring about significant product changes. The subsequent publication of the inclusive design standard provided a greater depth of information and in doing so addressed some of the early organisational issues to secure more long-term commitment to inclusive design. In particular, the involvement of equipment supplier design staff and also non-design related supplier representatives in the development of the standard, provided opportunities for education and feedback, to ensure that organisational issues were addressed.

Confidence in the viability and appropriateness of the standard was secured through the use of a panel of independent experts and also practical testing of existing products by disabled users. The latter particularly demonstrated to supplier representatives the existence of design exclusion and provided valid and trusted data on which to act, as one focus group participant outlined:

> *"The independent testing by individuals who have specific health conditions is vital in proving the actual fitness for purpose. We would not ask for any changes to this process."*

(Focus group participant, Session 8, 13th March 2008)

Consequently, equipment supplier design staff involved with the standard's development process have gone beyond a basic retrofit approach and have implemented the inclusive design standard through more integrated strategies. However, significant implementation issues surrounding inclusive design remain, with the most commonly reported reason for reticence to change being the perceived and real costs of adopting inclusive design, particularly in terms of high initial outlay and poor return on investment due to limited market size. The result of these issues is that some organisations have not been prepared to invest in inclusive product changes or the full integration of inclusive features.

Organisational structures within the fitness industry have also caused additional barriers to adoption of the inclusive design standard. In particular, for those with non-UK based parent companies and design teams, the process of educating the wider organisation and convincing senior management to adopt an inclusive design approach was problematic. In competing with other organisational priorities, UK-based personnel found difficulties in persuading relevant company decision makers to divert resources towards inclusive design, encountering misconceptions and reluctance to venture into what was seen as a relatively high-risk, new and untested market. However, feedback from the equipment supplier design staff questionnaire suggests that the written nature of the inclusive design standard was helpful in these situations in establishing common terminology, specific parameters and grounds for discussion. The standard itself provided detailed and comprehensive design information, from which design commissioners were better able to make a more complete assessment of the implications of inclusive design for their companies. Specifically, the standard provided information from which costs and resources could be calculated. The performance-based nature of the requirements was particularly valuable in giving organisations control over the level of commitment and investment needed to achieve compliance, through allowing a range of solutions from low-cost retrofits through to higher-cost options involving significant retooling, whilst still achieving more integrated features for disabled users. Further drivers for overcoming this organisational inertia were the ability to access new markets as well as the perceived prestige and potential marketability that compliance with the standard could attract. Increasing consumer confidence through attaining IFI Accreditation, of which compliance with the inclusive design standard forms an integral part, alongside the increasingly global recognition of the standard's content, has allowed relatively small design teams or geographically distant individuals to influence senior management to begin to invest in inclusive design. In this respect, the standard has been able to dually impact on realistic cost assessments and also provide increased profile and brand building potential for those organisations wishing to take up inclusive design practices.

Provision of the inclusive design standard has been an effective means to secure organisational buy-in from a number of fitness equipment suppliers through the promotion of awareness, knowledge and the business case for inclusive design. The resulting investment in product developments made by these organisations has raised the inclusive design ceiling, moving them beyond simple retrofit approaches to provide more comprehensive and integrated features which better meet the needs of disabled users. Through a process of education and awareness-raising, facilitated by the provision of technical design data, it has therefore been possible to overcome organisational inertia and initiate a cultural change within the fitness equipment industry towards more inclusive design practices.

8.4 Sustaining Inclusive Design Practices

To sustain the inclusive product developments instigated by equipment supplier design staff and continue organisational engagement with inclusive design, it will be imperative to build upon those factors which have successfully raised the inclusive design ceiling and provided examples of good practice thus far. Having already established methods for incorporating inclusive requirements, lessons learnt should make future integration of these approaches more streamlined within the product development processes of the equipment supplier design teams involved. It is likely, however, that the long-term sustainability of inclusive practices will be chiefly determined by profitability, as one focus group participant outlines:

> *"Funding for change is sales driven, therefore if sales go up so will the funding, and research and development of that area".*

(Focus group participant, Session 3, 21st January 2004)

To maximise profitability it will be necessary to maintain the inclusive design standard to ensure its continuing relevance, usefulness and to incorporate any new examples of best practice as they are discovered. Providing equipment supplier design staff with ongoing access to pertinent data will enable them to utilise their innate design skills and creativity to the fullest extent in order to construct well designed and appealing products for the widest range of users. Maximising market potential and driving sales in this manner will support the business case and justification for fitness equipment supplier organisations' continuing investment to meet the requirements of the inclusive design standard, and to adopt increasingly integrated and cost-effective development strategies.

Equipment supplier design staff are now engaged with the concept and practice of inclusive design through the information contained within the standard. To capitalise on this interest, as the necessarily product-focused standard is not intended to be used completely in isolation, the next step may be to encourage these design teams to explore complementary user-centred methods. Approaches which specifically involve working with and understanding users, such as more extensive prototype testing or user observation, may be particularly beneficial for expanding product designers' overall knowledge, skills and expertise, as well as enabling the detailed design of individual products to be refined. Introduction to inclusive design through the development of the standard has alleviated many of the initial fears and misconceptions experienced by both equipment supplier design staff and the organisations within which they operate. Consequently, these groups should be better placed to continue to consider and to view interaction with disabled users as a valuable asset in their design processes.

8.5 Conclusion

Through consideration of the original hypothesis and the five research objectives set to examine this initial supposition, the current chapter has drawn together pertinent findings and conclusions concerning the efficacy of the research approach and the effectiveness of the inclusive design standard within the fitness equipment industry. Impacts of user involvement, sampling and the diversity of the disability population have been considered from a user perspective, whilst the effects of timing and the provision of comprehensive inclusive design information on product development have been examined for equipment supplier design staff. The importance of awareness-raising, education and the business case in gaining organisational support and investment for inclusive design have been outlined, alongside the wider impact of the standard on the fitness industry, international standards development and inclusive design communities. Despite numerous factors influencing the effectiveness of the inclusive design standard and the level of inclusivity achieved, this chapter has been able to demonstrate a positive cultural change towards the needs of disabled people within the fitness equipment industry through increasingly integrated product development strategies. Lastly, to further raise the inclusive design ceiling, suggestions for sustaining inclusive design practices and continuing industrial engagement with the approach have been presented. The following chapter concludes the thesis by re-stating the major research findings in relation to their original contribution to knowledge and also provides suggestions for future work.

Chapter Nine: Key Conclusions and Contribution to Knowledge

9.1 Introduction

The inclusive design of mainstream commercial fitness equipment is a newly emerging field, instigated and developed in part by the current research, which has investigated the provision of a technical design standard as a methodology to introduce this discipline to the industry. In terms of supporting the adoption of inclusive design practices by equipment supplier design staff and the organisations within which they work, three broad and substantive conclusions can be drawn from the study.

Firstly, that through ethnographic research techniques it has been possible to develop a comprehensive, user-informed consortium standard, valuable to the fitness equipment design industry.

Secondly, that consolidating key principles into a written manuscript has provided specialist knowledge to equipment supplier design staff, educating and increasingly enabling them to overcome barriers and better respond to the needs of disabled people within their product designs.

Thirdly, organisational factors play a role in influencing the uptake of inclusive design practices, and successful adoption has required a significant cultural change from the supplier organisations involved, partly initiated by a process of education and information provision with which to assess resources and make business case decisions.

This chapter reviews these major research findings in relation to their original contribution to knowledge and the work of other authors. Finally, implications and opportunities for future work are presented to draw the thesis to a close.

9.2 Key Conclusions and Original Contribution to Knowledge

Comparison of the research contained within this thesis to that of other authors enables consideration of the originality of the study to be made and also allows the key research findings to be placed within a wider context.

9.2.1 Standardisation of Diversity

Employing ethnographic and independent research methods with multiple stakeholder groups uncovered widespread design exclusion within commercial fitness equipment, with a lack of pre-existing inclusive design information identified as a key contributory factor. Consequently, the directly expressed and latent needs of a wide range of disabled users have been captured through practical product testing, with key themes drawn out and consolidated to yield detailed new insights into the needs of disabled users concerning fitness equipment. Expert evaluation of the data, via a structured process of consultation and negotiation with industry professionals, validated the information and through bringing together equipment supplier design staff to consider this new area and by taking cognisance of their needs, led to a standard with wide consensus on its content.

The information and knowledge contained within the inclusive design standard provides a detailed understanding of the issues facing disabled users of fitness equipment and recommends ways of improving the interaction of disabled people with such products. It makes recommendations as to the design needs of the disabled population beyond those previously addressed by the fitness industry, both in terms of range of users and product types, providing new knowledge to aid in the design of products and the accessing of new markets. This is a major contribution to knowledge in this area for the fitness equipment industry.

Despite the diversity of the disabled population limiting the level of inclusion achievable, ethnographic research methods involving a considerable sample of users, have for the first time enabled a broad group of disabled people to influence the design of commercial fitness equipment. By including this significant sector of the population and considering their design needs, case studies show strong evidence that the inclusive design standard has facilitated the adoption of new product features and a transition of equipment provision for disabled people from medical to mainstream fitness environments. As well as being valuable to the fitness equipment industry in adopting inclusive design practices, by offering healthy lifestyle choices and maximising self-sufficiency for disabled users the standard has been able to directly address some of the concerns of authors such as Bennett (1999) and McGough (1999) surrounding not only specific equipment features but also the wider social inclusion of disabled people within the fitness environment.

9.2.2 Provision of Inclusive Design Resources

Product designers working within fitness equipment organisations are now routinely engaged with inclusive design as a result of the specialist knowledge provided in the inclusive design standard, which has offered information not only to identify, but also to minimise design exclusion within their products. This outcome legitimises the views of authors such as Dong *et al.* (2003b) and Keates and Clarkson (2003a), who have stressed the importance of providing tools for the design community to address the needs of the whole population, and suggests that technical standards may represent a viable resource to this end. Misconceptions such as the suppression of creativity, or the need to design for absolutely everybody, which align with those found in other industries by Keates *et al.* (2000) and the Disability Rights Commission (2001), have been overcome in this research by the provision of an educational specification for good inclusive design. By adding user information to guide the functional aspects of a product, rather than modifying conventional product development processes, equipment supplier design teams have remained free to use their own inherent skills to create its form whilst concurrently developing new expertise around inclusive design. These substantial contributions to knowledge and fresh inputs into the design process have given product designers within the fitness industry a better understanding of the needs of the people who will use their products, and broadened the scope of their approach, resulting in inspiration and focus for new, more inclusive, product designs. Progressively integrating inclusivity into mainstream fitness equipment in this manner has made a contribution towards the ultimate goal reported by Coleman *et al.* (2004, pg 1) “to ensure that, in so far as possible, the needs of the whole population are met through mainstream markets”. It has thus been shown that inclusive design does not need to be a niche activity but can be incorporated into conventional product design processes by design teams working within commercial organisations. Generally, the exclusion of disabled people from mainstream design appears to be as a result of a lack of awareness and information rather than a deliberate strategy on the part of designers and the organisations they work for. By providing fitness equipment designers with relevant user data, particularly at the formative stages of the design process, the result has been the successful adoption of inclusive design practices, supporting the premise that education and information are key to the uptake of inclusive design (Access Association, 2010).

9.2.3 Influencing Organisational Change

Established industry attitudes and organisational barriers to the uptake of inclusive design, for example prohibitive costs, small perceived market size and unrealistic design expectations, have been overcome in the fitness industry through the provision of information and education in the form of the inclusive design standard. This is the first evidenced demonstration of a significant shift in product designers’ practices and also organisational culture towards inclusive design within the fitness equipment industry.

In addition to providing specialist technical knowledge to equipment supplier design staff, the information contained within the inclusive design standard has also offered a previously unavailable resource to support and inform wider organisational practices. The standard has better equipped design managers to calculate costs and resources with which to consider the feasibility of adopting inclusive design. As a result of these more informed business case decisions, company representatives responsible for commissioning design have been increasingly willing to sanction equipment supplier design staff to implement inclusive design practices. Organisational employees with no innate link to the design process, such as those in marketing or sales, have benefitted from these new inclusive product offerings to access a previously untapped market sector, and have also capitalised on compliance with the standard as a means to gain external recognition and marketability to increase return on investment for these products. For the first time, raising awareness and demonstrating the relevance of inclusive design across multiple facets of fitness equipment supplier organisations has been achieved, bringing together differing interests within these companies to collectively support the adoption of more inclusive design practices. Consequently, cultural change has occurred at an organisational level within the fitness equipment supply industry, resulting in a commitment to invest in new, more accessible product designs and suggesting a pivotal role for these organisational factors in influencing the uptake of inclusive design practices by equipment supplier design staff. The importance of these transformations should not be underestimated, with the research findings supporting Coleman *et al.*'s (2004, pg 3) view that in order to get buy-in to inclusive design "cultural change is an essential and central feature". Evidence from the fitness industry suggests therefore, that as well as assisting product designers with practical implementation, provision of relevant design information can support awareness raising and cultural change, and thus be an effective means of compelling whole organisations to engage with inclusive design. This major contribution to knowledge also endorses Dong *et al.*'s (2003a, pg 106) view that "a change of attitudes towards people with disabilities by people commissioning, as well as performing, design and the provision of design support tools are necessary to bring inclusive design theory and practice closer together". Within the fitness equipment industry, the inclusive design standard has impacted at both organisational and product designer level, and has been able to turn inclusive design theory into practice, manifest in the development of new products in the mainstream marketplace.

9.3 Possibilities for Future Work

With the inclusive design standard established, opportunities now emerge to further increase the effectiveness of the research. It will be important to continue to raise awareness and aptitude for inclusive design within the fitness industry and to replicate the research methodology within other industries in order to validate the approach. Effort may be directed towards standards education, conceivably through training courses, seminars and workshops, or the development of complementary guidance notes to incorporate examples of best practice and more detailed explanations on the application of inclusive requirements. It may also be beneficial to compare the uptake of an inclusive design standard by organisation-based design staff against use by freelance designers operating outside of a formal institutional structure, in order to further investigate the influence and nature of wider organisational factors.

In order to sustain the impact and relevance of the research findings to fitness equipment design, further enquiry will be required to review and maintain the standard. It will be necessary to keep its content up to date, incorporating new technologies and products yet to be developed. It may also be beneficial to expand its scope to include associated products, such as those specifically for children, or outdoor fitness equipment. As part of a programme of continuous improvement, it may also be useful to evaluate current levels of design exclusion in inclusive fitness products in order to feed this information back into, and further enhance, the inclusive design standard.

Focussing on the long-term impact of the standard, there may be opportunities to consider the sustainability and uptake of these new inclusive products in the marketplace. This could involve an assessment of whether inclusive design has continued to be a valued and viable commercial approach for both equipment supplier design staff and also the organisations within which they work, or alternatively from the perspective of facility operators, whether investment in inclusive products has encouraged a greater membership of disabled people. It may also be possible to investigate whether removing design exclusion from fitness products has increased participation in physical fitness by disabled people, and whether this has made a subsequent impact on the general health and social inclusion of the wider disability population.

9.4 Conclusion

Effective implementation of inclusive design has for the first time been achieved in the fitness equipment industry through provision of the inclusive design standard, which offers evidence to substantiate the research hypothesis that:

Producing a user-informed, consortium standard is an effective means to support designers in adopting inclusive design practices for commercial fitness equipment.

By providing a substantial contribution to knowledge and technical guidance for equipment supplier design teams, therefore enabling disabled people to impact on the design process, the inclusive design standard has also been beneficial in facilitating organisational change towards considering the needs of a wider population. In combination, provision of this specialist knowledge, along with influencing organisational attitudes, has led to new ways of working and inclusive developments in mainstream fitness equipment design, thus indicating the efficacy of the research approach in promoting inclusive design practice by developing a consortium standard.

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Appendices

Appendix A:	Inclusive Fitness Initiative (IFI) background information
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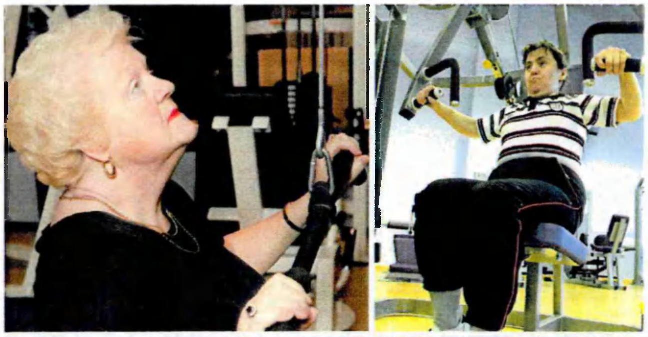
Appendix A: Inclusive Fitness Initiative (IFI) background information

The Inclusive Fitness Initiative

Getting People Active

"Across Europe there are 50 million disabled people. What the IFI has done in Britain, providing access, staff training, marketing and specialised fitness equipment is a showcase and should be used as a model for similar programmes across the continent."

Richard Howitt, MEP – President of the European Disability Intergroup of MEP's



"I would say that the help from the gym staff is better than very good; the receptionists are also very helpful and friendly."

User at IFI Site

The impact of Inclusion

Since 2001, the Inclusive Fitness Initiative (IFI) has been working with the fitness industry, creating opportunities for disabled people to workout in a truly inclusive environment. By the end of 2009, the IFI will have launched 400 accredited facilities across England, meaning that more disabled people than ever before have access to an accredited Inclusive Fitness Facility.

The IFI is not simply about access to buildings, it is about a cultural and attitudinal change, a change in the way a facility operates and in the way it is viewed by the community surrounding it. The IFI's mission is to support the fitness industry to offer truly inclusive physical activity opportunities. With only 8.8% of disabled people being regularly physically active, IFI Sites offer the opportunity to challenge this issue in a truly inclusive environment. (Sport England Active People Survey 2006).

The IFI model addresses inclusion in the widest sense making developments in the following areas:

- Creation of accessible facilities to meet current best practice and legislation
- Installation of inclusive fitness equipment, underpinned by a coordinated programme of research and development
- Training of staff throughout the facility ensuring that disabled people receive a safe effective and value for money experience
- Implementation of inclusive marketing strategies to ensure that disabled people are aware of the opportunities available and that the industry promotes a more inclusive and accessible image

What to expect at an IFI Site

As a disabled person wanting to get involved in fitness, what should you expect at an accredited IFI Site?

"If I came alone without my carer I would still be able to get to the changing room and then into the gym by myself which is fantastic."

Disabled user at an accredited facility

- Accessible facilities, ensuring you can gain access to the facility and the services available
    - 89% of disabled users at IFI Sites rated accessibility as very good or good
- A positive staff attitude
    - 94% of disabled users at IFI Sites found the service and support offered by staff to be very good or good
- Inclusive fitness equipment enabling the vast majority of users to get a full body workout
    - 80% of disabled users rated access to fitness equipment either as very good or good

The Benefits of Using an IFI Site

- First and foremost, exercise can be fun!
- Physical activity reduces the risk of some cancers, cardiovascular disease, type II diabetes and obesity
- Being physically active reduces the risk of depression and has positive benefits for mental health - including reduced anxiety, enhanced mood and self-esteem
- Physical activity reduces the risk of falls and accidents amongst older people or people with limited mobility

Getting Active

- On average IFI Sites attract 128 visits by disabled people and provide an induction for 9 new disabled users per month
- Over 50% of disabled users attracted to IFI Sites have never used a fitness suite before – a completely new market
- In 2007 IFI Sites attracted around 370,000 visits by disabled people. In 2008 this figure is projected to rise to 571,000
- In 2007 over 28,000 disabled people joined an IFI Site. In 2008 this figure is set to rise to over 40,000
- 96% of disabled customers would recommend the experience of using their local IFI Site to others
- Nearly 50% of all disabled users visit the gym twice or more a week

An Industry Impact

- The IFI has now provided advice on access and communication to over 300 fitness facilities in England
- Over 5,000 members of staff at IFI Sites have received disability awareness training. A further 5000 staff will be trained by the end of 2009

- 1,500 fitness instructors have received specific training enabling them to provide inclusive fitness programmes. A further 1500 staff will be trained by the end of 2009
- Over 90% of all tenders for new fitness equipment now specify the requirement for IFI accredited fitness equipment

Breaking Down Barriers

- The IFI has employed a network of Regional Inclusive Activators working with facilities to attract more disabled users
- Over 2million promotional leaflets have been distributed by IFI Sites
- Media coverage focusing on the IFI has a cumulative readership in excess of 5million
- The IFI website attracts 100,000 hits per month and offers the opportunity for disabled people to find their nearest accredited facility
- The delivery of the first ever national level conference focusing upon inclusive fitness attracted over 300 industry professionals (December 2006)
- The IFI was shortlisted in the final three Best Health Projects at the National Lottery Awards 2007.

Fitness Equipment Developments

- The IFI has established a partnership between equipment suppliers, Sheffield Hallam University and disabled people, leading to a research group and fitness equipment testing system
- The IFI has now published its Equipment Standards – Stage Two, against which equipment is currently being assessed
- The IFI has accredited fitness equipment from over 20 different fitness equipment suppliers that provides inclusive features
- IFI equipment developments have a global impact with standards being formally recognised within the European Standard for Stationary Fitness Equipment

An Inclusive Future

The IFI has already achieved a great deal, yet there is still more to be done. With a clear aspiration to ensure that disabled people from across the UK have access to inclusive fitness opportunities within a reasonable distance from their homes, the fitness industry must rise to the challenge, include all sectors of the community and then realise the commercial benefits.

This document is available in alternative formats.
Please call 0114 2572060

Inclusive Fitness Initiative, c/o MLS, 4 Park Square, Newton Chambers Road, Thorncliffe Park, Chapeltown, Sheffield, S35 2PH.

Tel: ++44 (0)114 2572060 (Textphone users add prefix 18001) Fax: ++44 (0)114 2570664

Email: info@inclusivefitness.org www.inclusivefitness.org

The IFI is run by The English Federation of Disability Sport Operating Company, (Chairman B P Atha CBE, OBE) which is a wholly owned subsidiary company of the English Federation of Disability Sport (CEO Colin Chaytors): EFDS, Manchester Metropolitan University, Alsager Campus, Hasall Road, Alsager, ST7 2HL. www.efds.co.uk.

Appendix B: List of fitness equipment suppliers providing products for practical testing

Suppliers Providing Fitness Equipment Products For User Testing Sessions

1. Bodycare Products Limited
2. Concept 2
3. Cybex International
4. Escape Fitness
5. EXF
6. Focus 21
7. HUR
8. Idass Fitness
9. Keiser UK
10. Leisure Lines
11. Life Fitness
12. Matrix (Johnson)
13. Mobility Aids Centre
14. Nautilus
15. Physique
16. Podiatron Ltd
17. Polaris Fitness Limited
18. Powerplate UK Ltd
19. Powerjog
20. PowerSport
21. Precept
22. Precor
23. Pulse Fitness
24. Reach Wellness
25. Shapemaster Toning Systems
26. Sportesse
27. Stairmaster
28. Star Trac
29. Technogym
30. Unicam Rehabilitation Systems Ltd
31. Versaclimber
32. Waterrower
33. Whiteley Nominees PTY Ltd

Appendix C: Invitation to fitness equipment suppliers to participate

English Federation of Disability Sport
Inclusive Fitness Initiative
Accreditation of Fitness Equipment

INCLUSIVE FITNESS

The English Federation of Disability Sport, through a dedicated Operating Company (EFDS OC), and a £1million grant from the Sport England Lottery Fund has successfully delivered a two-year pilot phase of the Inclusive Fitness Initiative (IFI). The IFI has grant aided local authority facilities to provide inclusive fitness equipment, training for fitness facility personnel and the production of marketing and sports development packages to encourage, support and sustain the use of fitness equipment by disabled people.

The IFI has now received an in principle commitment from the Sport England Lottery Fund to grant aid a further £5 million to the Initiative to deliver a national programme that will run for three years in 150 facilities throughout England.

Eighty-nine pieces of fitness equipment have been accredited by the IFI scheme to date. A further opportunity is now available for interested suppliers to submit pieces/models of fitness equipment for IFI accreditation. The nominated equipment should be suitable for effective use by both disabled and non-disabled people. The accreditation assessment will take place on 27th November in Wolverhampton. Any items of equipment subsequently approved will be accredited for a period of two years.

An information pack, including relevant application forms, is available from: Inclusive Fitness Initiative, 04 Park Square, Thorncliffe Park, Newton Chambers Road, Chapeltown, Sheffield, S35 2PH
Tel 0114 257 2060, Fax 0114 257 0664,
email info@inclusivefitness.org

The closing date for receipt of application forms is 24th October 2003.

English Federation of Disability Sport

SPORT ENGLAND LOTTERY FUND

Appendix D: Testers' questionnaire and scoring criteria including examples of completed items

Inclusive Fitness Initiative
Treadmills

Tester Number

Equipment Piece Number 10

Please score the following according to the scoring criteria:

CATEGORY **SCORE**

Ease of access on / off N/A 0 1 2 3 4 5

Ease of programming N/A 0 1 2 3 4 5

(e.g. how easy to start exercising, how easy to know how far through the program you are, how easy to change speed, size of writing on console, colours used, tactile information)

Turn over page

Range of speed	N/A	0	1	2	3	4	5
		☹	☹	☹	😐	☺	☺

(e.g. minimum / starting speed, increments in speed)

Use of emergency stop	N/A	0	1	2	3	4	5
		☹	☹	☹	😐	☺	☺

(e.g. position of emergency stop button, ease of use)

General comfort	N/A	0	1	2	3	4	5
		☹	☹	☹	😐	☺	☺

(e.g. position and size of handles, smoothness of machine)

Other comments, problems or suggestions

Point	Definition
0	Unusable
1	Usable with 100% personal assistance
2	Usable with additional equipment / personal assistance
3	Usable with minimal personal assistance
4	Usable with minimal additional / adapted equipment
5	Usable 100% independently

The main differences to be noted involve:

- **the degree to which you would need further adapted aids**
- **the degree to which you would need assistance from a fitness instructor to access the machinery. This does not include lifting and handling but such things as reaching up for inaccessible handles, moving seats etc.**

EXPLANATION OF TERMS

Ease of access into / onto	The degree to which you could get onto the equipment. Could it be accessible from either side? Did you require assistance getting onto the equipment?
Ease of access off from	Once on the equipment, did you need assistance to get off?
Range of movement	Did the way the equipment works suit your body shape? Did the exercise feel safe?
Range of resistance	Was there enough different weights / speeds for you to exercise at your desired level?
Adjustability	How easy was it to change the weights / speeds?
Comfort	Was seating comfortable? How did the padding feel?
Ease of use / programming	Was it technically complicated to use the equipment? Was there enough information provided? For cardio-vascular equipment, how easy was it to set up an exercise programme?

Inclusive Fitness Initiative
Treadmills

inclusive fitness

Tester Number 14765

Equipment Piece Number 15

Please score the following according to the scoring criteria:

CATEGORY	**SCORE**						
Ease of access on / off	**N/A**	**0**	**1**	**2**	**3**	**4**	**5** ✓
Ease of programming	**N/A**	**0**	**1**	**2**	**3**	**4** ✓	**5**

(eg. how easy to start exercising, how easy to know how far through the program you are, how easy to change speed, size of writing on console, colours used, tactile information)

Easy to change speed, with visual impairment not so easy to tell how far through a program – but not so important anyway.

Turn over page

Range of speed N/A 0 1 2 3 4 5

(e.g. minimum / starting speed, increments in speed)

starting speed ok, increments small enough.

Use of emergency stop N/A 0 1 2 3 4 5

(eg. position of emergency stop button, ease of use)

General comfort N/A 0 1 2 3 4 5

(e.g. position and size of handles, smoothness of machine)

Other comments, problems or suggestions

No comments for improvement suggestions.

Inclusive Fitness Initiative
Treadmills

Inclusive fitness

Tester Number 13041

Equipment Piece Number 15

Please score the following according to the scoring criteria:

CATEGORY		**SCORE**					
Ease of access on / off	**N/A**	**0**	**1**	**2**	**3**	**4**	**5**

Height was okay.
I like the indication of the colour of the border around the edges and the firmness.

Yellow or white handles preferred.

Ease of programming	**N/A**	**0**	**1**	**2**	**3**	**4**	**5**

(eg. how easy to start exercising, how easy to know how far through the program you are, how easy to change speed, size of writing on console, colours used, tactile information)

Extremely difficult, needs to be more tactile
Quick Start and Stop need to be more Pronounced *
The plus and minus, need to be marked differently
- If one was raised more than the other.
Couldn't read visual numbering
Need Audio.
Beeps need to be much louder to compensate for other sounds.

* Like that they are away from each other.

Turn over page

Range of speed N/A 0 1 2 3 4 5

(e.g. minimum / starting speed, increments in speed)

Ideal and incline ideal

Use of emergency stop N/A 0 1 2 3 4 5

(eg. position of emergency stop button, ease of use)

Need cord to be yellow and half length.
Brilliant idea for magnetic lock.

If colour changed.

General comfort N/A 0 1 2 3 4 5

(e.g. position and size of handles, smoothness of machine)

Silver front handles are fine because shiny.
Side handles to be yellow.
"Magic" (smoothness of machine) "Love the base"

Other comments, problems or suggestions

Lighter colour in general, black is problem.
Easier access with lighter colour.
Silver frames - fine

Inclusive Fitness Initiative
Treadmills

inclusive fitness

Tester Number	14779
Equipment Piece Number	15

Please score the following according to the scoring criteria:

CATEGORY **SCORE**

Ease of access on / off **N/A** **0** **1** **2** **3** **4** **5**

very easy

Ease of programming **N/A** **0** **1** **2** **3** **4** **5**

(eg. how easy to start exercising, how easy to know how far through the program you are, how easy to change speed, size of writing on console, colours used, tactile information)

Its very easy, big blue buttons, its very clear, buttons are very explicit, and the screen clearly shows you at what stage you are

Turn over page

Range of speed N/A 0 1 2 3 4 5

(e.g. minimum / starting speed, increments in speed)

what is the speed in? is it km or miles /ph?
the inceare is good.

Use of emergency stop N/A 0 1 2 3 4 5

(eg. position of emergency stop button, ease of use)

its very good that it is in the midle, easy to attach to the top when exercising.

General comfort N/A 0 1 2 3 4 5

(e.g. position and size of handles, smoothness of machine)

position of the hande is very good, but they are a bit to slippery, need more grip on them.

Other comments, problems or suggestions

It is one of the best presented consoles very clear, the additional information on the sides is usefull & clear.
like the bottle holders on both sides, for both left & right handed.

Appendix E: Summary of main equipment accessibility issues identified by testers

Summary of Main Equipment Accessibility Issues Identified by Testers (Presented by Generic Product Type):

Lower Body Resistance:

- Access issues with position of padding and range of movement required to get over padding, also difficulty of transfer from wheelchair (8 users)
- Weights too heavy and increments too large (10 users)
- Problems with seat height and/or difficulty using seat height adjustment (19 users)
- Unilateral use of equipment difficult (4 users)
- Stability issue - lack of trunk support/seat belt required especially at higher weights (open sided machines) (9 users)
- Seat uncomfortable (11 users)
- Need for tactile information (6 users)
- Use of colour contrast and colour coding (seat, upholstery, frame, adjustments, handles) (14 users)
- Adjustments heavy, stiff, poorly positioned, fiddly, hard to grip or awkward (25 users)
- Poor instructions for use - absent, poor position, incomplete, use of diagrams required, appropriate vocabulary (26 users)

Upper Body Resistance:

- Transfer issues - equipment unusable if unable to transfer/remove seat, lack of handles to assist transfer, difficulty removing seat (25 users)
- Difficult to achieve correct exercising position with wheelchair access (arms too far back) (10 users)
- Weights too heavy and increments too large, use of half weights desirable (15 users)
- Difficult to use unilaterally - grip difficult, unequal strength (12 users)
- Handgrips need redesigning and to be more adjustable (16 users, plus some from the unilateral use category)
- Stability issues - feel unstable/unsafe when exercising, lack of trunk support (open sided machines), need for seatbelt and/or back support (15 users)
- Seating issues - sliding off seat when pushing, seat too small, seat too hard/uncomfortable (22 users)
- Need for tactile information - especially on weight stack (11 users)
- Use of colour contrast and colour coding (pads, handles, seat, adjustments, weight pin, frame, upholstery) (29 users)
- Difficulty reaching high handles - can't use grab handle at higher weights, assistance required (especially lat pulldown) (18 users)

- Poor instructions - absent, poorly positioned, incomplete, use of diagrams required, appropriate vocabulary (33 users)
- Adjustments - heavy, stiff, poorly positioned, fiddly, hard to grip, awkward or difficult to reach (26 users)

Multistations:

- Access mostly restricted by seats being difficult to remove (10 users)
- Weights too heavy and increments too large (8 users)
- Adjustments heavy, stiff, poorly positioned, fiddly or hard to grip (7 users)
- Balance issues/concerns - need for stability points, support bars and handles (7 users, of which 3 users complained of their wheelchair tipping during exercise)
- Equipment thought to be too complex/complicated (8 users) and expressed need for assistance, tuition or support (20 users)
- Poor instructions - absent, small size, poorly positioned (12 users)
- High handles not reachable (8 users) plus requests for grab handles (4 users)
- Pulley unit difficult to move - hard, awkward, stiff or heavy (10 users)
- Difficult to identify weight selection and hole (8 users)

Treadmills:

- High step on height (3 users)
- Lowest starting speed too fast (3 users)
- Right-hand bias of controls (2 users)
- Handrails (position) good for confidence (9 users) - need sufficient length as well
- Preference for clip-on style emergency stop (6 users)
- Supervision/assistance required with programming (5 users)
- Console - tactile information (12 users), complex/too much information (13 users), audio feedback (8 users), more colour contrast (3 users)
- Controls on handrails or 'pod' simplifies use/more user-friendly (7 users)

Recumbent Cycles:

- Step over too high, good range of movement needed (8 users)
- Complicated equipment - instruction or assistance required (12 users)
- Console - complex/too much information (8 users), text too small (2 users), no audio feedback (5 users), better colour contrast (2 users), tactile information required (7 users)
- Problems with seat adjustment - hidden/difficult to find, hard to use/difficult to use or fiddly (13 users)

- Pedals and straps - getting feet into and fastening/adjusting (8 users), foot knocking central section of frame or falling out of pedals (heel strap required) (7 users), better colour contrast (4 users)

Upright Cycles:

- Seat too high even at lowest setting (11 users)
- Low step over height/no central section to step over (3 users)
- Seat adjustment difficult/stiff (5 users)
- Pedals and straps - poor ease of use (16 users), difficult to put feet in initially (5 users), feet falling out of pedals once exercising (heel straps required) (3 users)
- Console - complex programming (10 users), tactile information (4 users), audio feedback (2 users)

Upper Body Ergometer:

- Problems with wheelchair access - needs removable seat, seat difficult/heavy to remove, not clear floor access (8 users)
- Different shaped handgrips required (3 users)
- Seat belt required to aid balance (2 users)
- Poor instructions (2 users)
- Console - complex/hard/fiddly (3 users), tactile information required (1 user)

Elliptical Trainers:

- Difficulty getting on and off - stability and confidence issues, requests for support for balance (7 users)
- Console - no tactile information (4 users), audio feedback (2 users), complex programming (5 users)

Steppers:

- High step on height (5 users)
- Poor instructions (2 users)

Rowing Machines:

- Seat uncomfortable (2 users)

Appendix F: Example of focus group agenda and minutes

EFDS INCLUSIVE FITNESS INITIATIVE

INCLUSIVE FITNESS

Research Associates R&D Forum

Monday 24th March 2003
Wentworth 3 (Room 5511), 5th Floor, Surrey Building, City Campus,
Sheffield Hallam University, Sheffield

Agenda

10.30am **Coffee**

11.00am **Welcome & Introductions**

11.15am **Introduction to the Inclusive Fitness Initiative**

- Overview of the IFI
- IFI aims and successes
- Need/market for inclusive design (DDA etc)

11.30am **Introduction to IFI Research Project**

- Funding and management arrangements
- Aims and objectives
- Approach to work programme
- Expected outcomes

11.45am **Introduction to Sheffield Hallam University, School of Engineering**

- Sports Engineering Lab and other testing/design facilities

12.00noon **Introduction to R&D Forum**

- Ground rules (confidentiality, informal, etc)
- Input required from R&D representatives
- Expected outcomes

12.30 - 1.30pm **Lunch**

1.30pm **Open Forum**

To discuss topics including:

Suppliers approach to design, current knowledge of disability issues, barriers to inclusive design, R&D requirements from IFI Project, information required (format, quantity, timescales), accreditation/self-certification process

3.30pm **Q&A Session followed by tour of School of Engineering facilities**

4pm **Close**

English Federation of Disability Sport

SPORT ENGLAND LOTTERY FUND

F1

The Gary Jelen Sports Foundation

MontgomeryLeisureServices

Minutes of IFI Research Associates R&D Forum

Monday 24th March 2003
Wentworth 3 (Room 5511), 5th Floor, Surrey Building, City Campus, Sheffield Hallam University, Sheffield

In Attendance:

[redacted]

Cybex
Escape Fitness
Leisure Lines
Matrix
Nautilus Group
Precor
Pulse
Pulse
Sportesse
Technogym
IFI/MLS
Supplier Representative
Sheffield Hallam University
Sheffield Hallam University

Apologies:

Life Fitness
Versaclimber

1. Welcome & Introductions

2. Introduction to the Inclusive Fitness Initiative

Will Behenna gave a presentation and discussed the following issues with suppliers:

2.1. Overview of IFI
Explanation of the main areas covered by the IFI (Equipment, Training, Marketing, Sports Development)

2.2. Experiences of disability
Although some suppliers had personal experience of working with disabled people most suppliers reported that their main experiences of disability were those coming from the IFI accreditation sessions. A brief version of the YMCA Level One Disability Equality Training was presented which concern conditioning and the perception of disability.

2.3. Disability Market
Presentation of statistics concerning the number of disabled people in the UK and the £40 billion annual spending power of disabled people. Suppliers requested that this information be emailed to them. Discussion of an aging population increasing the incidence of disability and so the already large disability market (approximately 8

million people) is likely to increase in size over the next few years. The point was raised that many of the equipment changes for disabled people would also benefit non-disabled people.

3. Introduction to IFI Research Project

Dawn Hughes gave presentation on the research project covering the following points:

3.1. Research Project
The research is a 3 year PhD project funded by multiple partners including equipment manufacturers and suppliers and based at Sheffield Hallam University.

3.2. Aims
(i) Comprehensive guidelines on design
(ii) Self-certification process for implementation
(iii) BS EN 957 incorporation

3.3. Process
(i) Barriers to inclusive design - identification
(ii) Information gathering via forums (User, Facilitator, Supplier)

3.4. Supplier Forum
(a) Barriers to design
- (i) Knowledge of disability issues
- (ii) Other barriers - cost, resources, time, etc
- (iii) Information and assistance

(b) IFI Accreditation
- (i) New accreditation - format (self-certification), timescale, standard
- (ii) Accreditation by impairment groups and/or star rating?

3.5. Issues
- Project to help not hinder suppliers
- University is impartial

4. Introduction to Sheffield Hallam University, School of Engineering

Nick Pickett gave a presentation covering the following topics:

4.1. Sports Equipment Development Course
Nick Pickett gave an overview of the course and highlighted the benefits for both students and suppliers of student placements and/or projects within the fitness industry.

4.2. Testing Facilities
An offer was made to all suppliers involved in the IFI Research project to use Sheffield Hallam University's testing facilities. It was stressed that the work could be performed to BS EN standards (possibly to check and confirm companies self-certification work) and all work would remain confidential between the University and the supplier involved. The School of Engineering works in association with the Centre for Sport and Exercise Science and these test facilities could also be made available to suppliers (including the biomechanics and motion analysis laboratories).

5. Tour of School of Engineering facilities

Suppliers were given the opportunity to view the dedicated Sports Engineering Laboratory and other testing facilities within the School of Engineering at Sheffield Hallam University.

6. Open Discussion Forum

6.1. Topic One: Barriers to Design

Exercise:
The group split into smaller groups for a brain-storming session. Each group was given an impairment group and was asked to consider the use of CV, resistance and free weight equipment in relation to

- Access
- Communication
- Environment
- Attitude

Findings:
The following summarises the main points identified during the brain-storming session:

Physical Disability

- Most CV equipment focuses on the lower body
- Low starting speed
- Low step-up or step-over height
- Need to press buttons including the emergency stop
- Seats
- Grips
- Stability straps
- Unilateral movement
- Instructions - aimed towards disabled? Pictorial
- Handles
- Adjustments
- Low start weights
- Pre-stretch mechanisms
- Space between equipment (turning circles, space for helpers)
- Assumption made by instructors about peoples abilities
- Disability training required - suppliers provide a training package/induction but generally do not include disability issues

Hearing Impairment

- Balanced affected therefore additional handrails
- Clear visuals needed to compensate for audio feedback
- Auto shutdown for treadmill as can't hear if moving
- Clear written instructions. Video? Sign language?
- Written induction material so can take away from session. Jargon?
- Demonstration important

Visual Impairment

- Product orientation and recognition
- Colour contrast - adjustments, flooring, walls
- Tactile
- No sharp edges, protruding pieces
- Ramps not steps
- Consoles - pattern to buttons, colour contrast, tactile
- Standardisation across range e.g. seat adjustment
- Panic button
- Clear space around equipment
- Training and induction
- Lighting
- Identification of weight selected
- Confusion with mixed weights e.g. lbs, kgs etc

Learning Difficulty

- Obvious entry point to the machine
- Instructions and charts - pictures
- kgs, lbs etc - what do they mean?
- Easy set-up
- Distractions - noise, layout too busy, loud music
- Guided learning
- No of commands before machine starts
- Reading and writing - console?
- Daunting environment

General observations

Suppliers commented that a number of issues they identified during the session were common both across disability groups and across equipment types. Solving these issues could help a large number of disabled people and may not be particularly expensive or complicated to implement.

Compromises would have to be made between the needs of certain disability groups who require opposing features on equipment.

6.2. Discussion:

Dawn Hughes asked suppliers for feedback on other issues which were currently barriers to inclusive design. The following barriers and other concerns were raised and discussed:

- Cost (passed on to all users including disabled and non-disabled) - need simple, low cost changes.
- R&D departments not in UK make responding to change difficult. Suppliers requested research should produce information in a written format which can easily be sent to other departments in company.

- Disability needs to be considered at an early stage in the design process - often too late for changes to be implemented after initial designs are finalised. Market lead times likely to be 12-18 months.
- Attitude of the company the design works for - need to justify resources and compare sales with equipment changes to sales without equipment changes.
- UK is not the only market suppliers are involved in, other countries are not considering disability issues.
- Limited knowledge of how to produce good inclusive instructions for equipment (Dawn Hughes to investigate and feedback to suppliers).
- Limited feedback in the fitness industry from disabled users.
- Need for numeric design data on sizes, forces etc for wheelchairs.
- Need for list of 'considerations' when designing for each disability group (e.g. position of adjustments, colour contrasting etc).
- Changes made for IFI accreditation must also comply with BS EN 957 requirements.
- Access aids - suppliers have no information about current access aids (e.g. radius of grip).
- Differences in national standards for sizes of bars, labelling of weights etc.
- Design changes must not compromise use by non-disabled customers.
- Limited availability of equipment for designers to use e.g. range of wheelchair types and sizes. IFI to possibly arrange a visit for the suppliers to try some different wheelchairs in a gym environment?

6.3. Topic Two: IFI Guidance & Accreditation

Suppliers requested that information should be disseminated from the IFI research project by impairment group. The alternative of giving guidance by equipment type (e.g. treadmills, cycles) or equipment features (e.g. console, pedals) was thought to be unfair as some suppliers only produce one type of equipment and may have to wait for a significant period of time until guidance appropriate to their equipment becomes available.

Suppliers requested that the guidance should list features which should be considered, accompanied by a number of possible solutions to achieve inclusive design of these features. Suppliers requested a number of solutions to be presented to allow increased scope for product differentiation between companies.

Suppliers discussed the format the IFI accreditation should take and initially stated a preference for classification by impairment group and then a star rating applied within each impairment group. Concerns were raised that this may lead to local authorities choosing the equipment with the highest star rating in each category, which may lead to equipment from a mix of suppliers. This would limit the consistency of design features (e.g. the console) across equipment which is important for a number of impairment groups (notably visually impaired and learning difficulties).

7. Any Other Business

Dawn Hughes raised the issue that she was having difficulty in finding numeric data on features such as step-up height, size of starting weight etc from supplier sales literature alone. She asked if suppliers would be happy for her to email the R&D representatives to request this information. The suppliers agreed that this would be acceptable.

Suppliers felt that a session on 'marketing to disabled people' at the next R&D forum would be beneficial for them.

8. Close

Appendix G: Draft for Development

(Stage One)

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Inclusive Fitness Initiative

Fitness Equipment Standards
Stage One
1st April 2004 to 30th April 2006

Author – IFI Equipment Panel on behalf of the
English Federation of Disability Sport Operating Company

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Inclusive Fitness Initiative
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1. The Inclusive Fitness Initiative – Background

Research conducted by Montgomery Leisure Services (MLS) on behalf of the Gary Jelen Sports Foundation during 1998 identified a lack of provision in fitness facilities for disabled people; a lack of disability awareness among facility staff providing a barrier to participation and a lack of knowledge amongst disabled people of the benefits of exercise. It was clear that without intervention, the traditional forces of supply and demand were unlikely to address the needs of disabled people in the health and fitness environment. The Inclusive Fitness Initiative (IFI) has been developed as a proactive response to these challenges, thanks to a £6 million grant from the Sport England Lottery Fund. A wholly owned subsidiary company was set up by the English Federation of Disability Sport (EFDS) to direct the policy and strategy for the IFI with MLS appointed to manage the operational delivery of the scheme.

Grant aid is available to not for profit facilities to support them to become inclusive, but all the IFI components have relevance to the private sector also. The four primary areas of delivery include:

- **Inclusive Fitness Equipment** - Ensures that both disabled and non-disabled people can access a full body workout in the same way, at the same time and using the same equipment. This document provides information on the development of inclusive fitness equipment standards.
- **Staff Training** - Ensures that staff are confident and competent when catering for the needs of disabled people. Training is delivered at two levels; level one supports all front of house staff with disability equity training and level two targets fitness instructors specifically (accredited to NVQ level 3).
- **Inclusive Marketing Strategies** - Ensures that not only do facilities cater for the needs of disabled people but also that they communicate the benefits and opportunities of gym based physical activity effectively with disabled and non-disabled people.

- **Inclusive Development** - Not for profit facilities receive support to enable them to develop alternative physical activity opportunities for disabled people in an inclusive context.

The combination of these elements ensures that the IFI addresses inclusion in a truly holistic fashion, not only concentrating on physical access to facilities but also the barriers associated with culture, communication and wider physical activity participation.

2. What Makes Fitness Equipment Inclusive?

2.1 IFI Equipment Accreditation

Since the beginning of the IFI, the project has strived to ensure that fitness equipment suppliers consistently address the needs of disabled users. The provision of fitness equipment was the initial objective in the early stages of the IFI project development. The fundamental requirement for the IFI is an identified range of equipment that provides a total body workout for disabled people.

The IFI now has over 60 experienced testers, each with different impairments and needs, who provide both qualitative and quantitative feedback. This supportive framework allows disabled people to give views honestly and confidently, but also evidences to suppliers the developments required in a non-threatening way, providing ownership of the challenges after seeing them at first hand. Suppliers then receive feedback from the IFI about the changes required to bring the equipment up to the required standard and solve the design challenges in an informed way.

Learning from the huge amount of data received at the accreditation sessions, feedback from suppliers and designers and feedback from users of accredited equipment during the IFI pilot scheme (2001 to 2003), the IFI has recently 'lifted the bar' in terms of the standards and features now required from an IFI accredited item. These Stage One Standards have been defined to meet the needs of each of the 'main' impairment groups:

- learning disability
- hearing impaired
- visually impaired
- physical disability

2.2 IFI Equipment PhD Research Project

At the request of equipment suppliers, stimulated by the IFI to learn more about how to provide suitable inclusive fitness equipment, a PhD Research project has been now initiated to provide clear guidance and standards to participating partners.

Based within the School of Engineering at Sheffield Hallam University and working with Professor Graham Cockerham Program Area Head for Engineering, Design and Technology and Nicholas Pickett leader of the Sport Equipment Development undergraduate course, Dawn Hughes (MSc Medical Physics & Clinical Engineering, MEng Mathematical Engineering) was appointed in December 2002 to drive a detailed investigation into all aspects of inclusive fitness equipment design over three years, building on the lessons already learnt from the IFI pilot scheme (2001 to 2003).

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The project is currently being funded through a partnership between the IFI, Sport England, Sheffield Hallam University, Montgomery Leisure Services and twelve major fitness equipment manufacturers and suppliers:

Cybex	**Matrix**	**Shokk**
HUR	**Nautilus Health & Fitness Group**	**Sportesse**
Leisure Lines	**Pulse Fitness**	**Technogym**
Life Fitness	**Precor**	**Versaclimber**

The programme takes a holistic approach, researching barriers and solutions by consulting with disabled users, fitness professionals at the delivery end and manufacturers' research and designers. The study shows that many of the problems faced by disabled people when seeking meaningful independent access to a piece of fitness equipment are not insurmountable. The target is that the new data and subsequent Stage Two Standards will provide a raised benchmark for inclusive, barrier-free, age appropriate design, which is practical, understood and 'owned' by all involved in the design and supply chain.

Globally, the UK fitness industry is now established as the world leader in inclusive equipment design and development. This project provides suppliers with a major competitive advantage in UK, European and world markets. Interested suppliers are invited to become a Research Associate at any time, subject to payment of a fee. Contact the IFI office for details.

From a UK perspective the fitness industry has seen a major increase in profile through its positive commitment to inclusion. In addition, the project and the **INDUSTRY is the first to develop an inclusive guidance document** using a multidisciplinary approach and providing a benchmark for inclusive safety standards. Ultimately the IFI seeks to fully integrate these raised standards into EN 957, the European safety standard for stationary fitness equipment to ensure that the needs of disabled people continue to be fully embraced in the design and manufacturing process.

2.3 IFI Fitness Equipment Standards – Stage One

The findings from the accreditation data and the IFI Research Project have been collated to develop these IFI Fitness Equipment Standards – Stage One. Equipment suppliers that are looking to distribute equipment through the IFI programme must conform to these Stage One Standards. Additionally, facilities not part of the IFI scheme are specifying IFI Accredited Equipment as an essential element of tender documents for refits and new build facilities to maximise their provision for inclusive use, broaden their market reach and meet the 'reasonable adjustments' required under the terms of Part III of the Disability Discrimination Act 1995. These Standards have had an impact industry wide.

Most notably, all inclusive fitness equipment must be accessible for disabled and non-disabled people alike. So as much as the IFI will not accredit equipment that is inaccessible to disabled people, the project will also not accredit equipment that is inaccessible to non-disabled people. The IFI Equipment Panel has compiled this document to clearly identify the design features required to receive IFI accreditation for fitness equipment on or after 1st April 2004.

Approach

This document aims to make clear the standards that have to be met to gain IFI accreditation and also which design features are relevant to different impairment groups. The production and publication of these Stage One Standards supports and maintains consistency of IFI equipment accreditation. Each impairment group (visual, hearing, learning disability, upper body and lower body impairment) has been considered. Each table is based upon a category of equipment as defined in EN 957, European Standard for Stationary Training Equipment, and details the standards required to meet the needs of each impairment group.

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Essential Requirements and Desirable Features

'Essential' requirements must be met to successfully achieve IFI accreditation on or after 1st April 2004. 'Desirable' features are those that the IFI Equipment Panel has identified offer benefits to disabled users. These features are not required to achieve IFI accreditation at this stage of development, but would enhance the products use. The IFI Equipment Panel consider that these features are important however, but that there is currently not sufficient time or knowledge for suppliers to make all these changes on every item of equipment. These 'Desirable' features also provide targets for future development and investigation and are currently the focus of consideration. The majority of these 'Desirable' Features are also likely to be incorporated into the enhanced Stage Two Standard in the future.

The IFI Equipment Panel is aware that this document is descriptive of some requirements and as such is still open to a degree of interpretation in some areas. Feedback from testers at IFI Accreditation sessions will also continue to be taken into account when assessing the suitability of potential IFI Accredited Equipment. Although the requirements presented in this document are not an outcome of the IFI PhD Research Project it is intended that as this project progresses, the requirements will become more detailed. Detailed guidance notes are available to suppliers involved with the IFI Research Project. Summary standards (as per this document) are available to other suppliers.

European Standards for Stationary Training Equipment (EN 957)

In addition to the inclusive design features, every item of IFI Accredited Equipment must comply with the relevant parts of the EN 957 Standard for Stationary Training Equipment. This Standard has been adopted by the IFI to ensure that the equipment meets the highest possible safety requirements. The European Standards Committee for Stationary Training Equipment (EN 957) has now formally recognised the importance of inclusion. Class I – Inclusive Use for Special Needs - has now been added to Part 1 of the Standard (General Requirements). Each member state will be required to reference the appropriate inclusive standards in their country. These IFI Fitness Equipment Standards – Stage One, have been added as a reference to the bibliography of the EN 957 Standard.

Whilst the other Parts of the Standard are yet to reflect inclusive requirements for individual items of equipment, this overarching requirement puts inclusion firmly on the map Europe wide. This recommendation by the EN957 Committee is subject to ratification by the overall Standards Committee in March 2005. This represents a major achievement for the English Federation of Disability Sport Operating Company, the UK Fitness Equipment suppliers and the IFI Equipment Panel for the work and drive in this area over the last four years. Particular thanks must go to Howard Davies, a member of the IFI Equipment Panel and the British representative on the EN957 Committee, who has skilfully presented and argued the benefits of inclusive equipment development.

2.4 IFI Accredited Equipment

Following the publication of the IFI Stage One Equipment Standards the IFI currently boasts 107 pieces of equipment from 18 different suppliers (December 2004) ensuring that all leisure managers have a good choice of inclusive equipment. A full list of current IFI suppliers and accredited equipment is available on http://www.inclusivefitness.org/suppliers/equipment.php This list increases on a regular basis.

2.5 The Future

Why Stage One Standards? The Standards will be in place until April 2006. There is still much progress to be made and still much work to be done in the area of inclusive fitness equipment design and development. Notice is already out that the 'bar will be lifted again'. The IFI Equipment Panel is currently drafting IFI Fitness Equipment Standards - Stage Two, which will be published in Spring 2005. The UK fitness equipment sector should be congratulated on the positive way in which they have embraced inclusion and invested in the design and development of equipment that meets the needs of everyone. Ultimately it is now up to the purchasers of equipment to select accredited inclusive fitness equipment to ensure that the needs of disabled and non-disabled people can be met as service providers.

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General Requirements

Essential elements applicable to all items of equipment

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disability
Equipment to comply with EN 957 European Standard for Stationary Training Equipment, with appropriate certification / validation	✓	✓	✓	✓	✓
Clear tonal contrasts to indicate moving parts and different functional components of the design			✓		✓
Clear colour contrast between the frame and upholstery			✓		
Obvious raised iconography, colour and texture on emergency stop	✓	✓	✓	✓	✓
Quick start function	✓	✓		✓	✓
Tactile grips	✓				
High handles and bars easy to change from a seated position		✓			
Accessible and usable by non-disabled people					

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General Requirements

Inclusive Fitness Initiative
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Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disabilit
Choice of frame colour available			✓		
Choice of upholstery colour available			✓		
Continuity of design detailing and product characteristics throughout the range			✓		✓
Pictorial messages (visible and audible)					✓
Adjustable handles to assist use by people with a wide range of back and arm lengths	✓				
Adjustable gripping angle to reduce the strain on the wrist	✓				
Easy to grasp pin and adjustment mechanisms to aid independent use by people with limited or no finger function	✓				
User able to independently set the range of motion with one hand	✓				
Range of motion adjustments centrally mounted	✓				
Bilateral and unilateral limb activity available	✓	✓			
Seat suitable for wheelchair transfer including: • Height adjustment that is able to be operated from seated		✓			
• Side handles		✓			
• Wide base		✓			
• Supportive foam		✓			
Seat padding to: • Provide support in the form of ergonomic moulding		✓			
• Provide reasonable protection for users with sensitive skin in short to medium term use (lower density, softer foam to help reduce movement and shearing)		✓			
• Adjustable to ensure appropriate body alignment and support		✓			

Inclusive Fitness Initiative
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Consoles

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disabilit
Centrally located emergency stop or emergency stops located on both the left and right hand sides of the equipment or kill cord or similar 'hands free' mechanism	✓	✓	✓		✓
Raised obvious iconography (pictures, images, logos) and, or raised digits, and or raised buttons on console for main controls (start/stop, up/down, increase/decrease speed) with clear colour contrast. (The raised digits should not be Braille. If Braille is to be added this should be along side the raised digits)			✓		✓

Consoles

Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disabilit
Raised iconography and raised digits on console for all controls			✓		✓
Clear colour contrast of information from background display			✓		
Large font size for information (to be clarified in the future) in sentence case, not capitals.			✓		
Audio function available to provide feedback during and at the end of the exercise			✓		
Variable audible feedback for all programmable functions			✓		

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Strength Training Equipment

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learnin Disabilit
Enclosed weight stack meeting the requirements of EN957 Part 2 – for third party protection	✓	✓	✓		✓
Stability testing as per BSEN 957 Parts 2 Weight Machines and Part 4	✓	✓	✓		✓
Locking key weight selection mechanism	✓	✓	✓		✓
Weight selection pin to be tactile and have definite colour contrast to the weight stack			✓		✓
Raised tactile numbers on the weight stack			✓		
Following machine parts to have definite colour contrast from remainder of the machine: • Seats - contrast against frame			✓		✓
• Adjustment mechanisms			✓		✓
• Bar ends			✓		✓
• Interfaces					✓
Adjustable start positions where necessary to prevent starting in a stressed position	✓	✓	✓		✓
Stability handles or points for use during functional exercise	✓			✓	

Strength Training Equipment

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disabilit
Low start weight relevant to the piece of equipment	✓	✓			
Hand rails accessible to ensure that users are able to actively support their torso during activity	✓	✓			
Seating system independently moveable (e.g. swing away seat) or removable by wheelchair user wishing to exercise from their own chair for all upper body strength equipment		✓			

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Strength Training Equipment

Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learnin Disabilit
Following machine parts to have definite colour contrast from remainder of the machine: • Interfaces (such as karabiners)			✓		
Non-slip material for seating			✓		
Pictorial representation of 'start' and 'finish' exercise positions on machine. Representation should be tactile, raised and have a definite colour contrast			✓		
Handles easy to change and adjustable with one hand (less fiddly than karabinas)	✓				✓
Maximum increments of 2.5 kg (at low weight values)	✓	✓			
Active and passive options available	✓				
Wider seat available for use by people with sitting balance problems. Recommend 15-20 inches but further guidance to follow	✓	✓			
Handles or surfaces available for transfer beside seats		✓			
Handles beside seat to be flush or below seat height		✓			
Bilateral access for transfer from a wheelchair or other mobility aid		✓			
Range of motion adjustment available		✓			

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Pedal Crank Training Equipment

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disabilit
Following machine parts to have definite colour contrast from remainder of the machine • Pins			✓		✓
• Seats - contrast against frame			✓		✓
• Adjustment mechanisms			✓		✓
• Handles			✓		✓
• Interfaces (such as foot straps)			✓		✓
Visual feedback about performance at the end of the workout				✓	✓
Bilateral access for transfer from a wheelchair or other mobility aid		✓			

Pedal Crank Training Equipment

Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disabilit
Auditory feedback about performance at the end of the workout			✓		✓
Lockable pedal cranks to provide a solid base for adjusting straps and aligning limbs	✓	✓	✓	✓	✓
Wider seat available for use by people with sitting balance problems. Recommend 15-20 inches but further guidance to follow	✓	✓			
Foot straps available to stop users feet from falling off the pedals and ensure correct ankle, knee and hip alignment		✓			
Handles or surfaces available for transfer beside seats (recumbent cycles)		✓			
Handles beside seat to be flush or below seat height		✓			

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Treadmills

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disabilit
Distinctive marking on belt to allow user to determine if belt is moving			✓		✓
Visible contrast between the running belt and the casing					
Quick or single button start			✓		✓
Maximum 1kmph start speed		✓	✓	✓	✓
Low incremental changes in speed		✓	✓	✓	✓
Functional hand rails provided for a minimum one third the length of the training surface. (As per EN957 – Part 6)	✓	✓	✓	✓	✓
Rear roller guard or similar protection (as per EN957 – Part 6)			✓		
Visual feedback about performance at the end of the workout				✓	✓
Guard rails provided for one third the length of the training surface (as per EN957 – Part 6)					✓
Bilateral access		✓			
Impact absorption system available		✓			
Centrally located emergency stop or emergency stops located on both the left and right hand sides of the equipment or kill cord or similar 'hands-free' option for emergency stop	✓	✓	✓	✓	✓

Treadmills

Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learning Disability
Auditory feedback about performance at the start and end of the workout			✓		✓
Low level step on and off		✓			

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Upper Body Ergometers

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learnir Disabili
Following machine parts to have definite colour contrast from remainder of the machine: • Seat - contrast against frame			✓		✓
• Adjustment mechanisms			✓		✓
• Interfaces (such as foot straps)			✓		✓
• Handles			✓		✓
Visual feedback about performance at the end of the workout				✓	✓
Seating system independently moveable (e.g. swing away seat) or removable by wheelchair user wishing to exercise from their own chair		✓			

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Upper Body Ergometers

Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learnin Disabili
Auditory feedback about performance at the end of the workout			✓		✓
Tactile adjustment of (pedal) arm crank length			✓		
Lockable interface to provide a solid base for adjusting straps and aligning limbs (lockable pedal cranks)					✓
Lockable pedal cranks to provide a solid base for adjusting straps and aligning limbs	✓				
Adjustable crank-arm (length of crank arm and height of point of rotation)	✓				
Wider seat available for use by people with sitting balance problems. Recommend 15-20 inches but further guidance to follow	✓	✓			
Handles or surfaces available for transfer beside seats		✓			
Handles beside seat to be flush or below seat height		✓			
Bilateral access for transfer from a wheelchair or other mobility aid		✓			

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Rowing Machines

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learnin Disabilit
Following machine parts to have definite colour contrast from the remainder of the machine: • Pins			✓		✓
• Seat - contrast against frame			✓		✓
• Handles			✓		✓
• Interfaces (such as foot straps)			✓		✓
• Adjustment mechanisms			✓		
Visual feedback about performance at the end of the workout				✓	✓
Bilateral access for transfer from a wheelchair or other mobility aid		✓			
Postural support compatible		✓			

Rowing Machines

Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learnin Disabili
Auditory feedback about performance at the end of the workout			✓		✓
Simple lockable seat	✓	✓	✓		
Tactile direction marker on seat to allow user to know which direction they should be facing			✓		
Option for single arm use	✓				
Handles or surfaces available for transfer beside seats		✓			
Handles beside seat to be flush or below seat height		✓			
Wider seat available for use by people with sitting balance problems. Recommend 15-20 inches but further guidance to follow		✓			
Foot straps available to stop users feet from falling off the pedals		✓			

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Stairclimbers and Steppers

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learni Disabi
Visible contrast between the training surface and the casing			✓		✓
Definite colour contrast on handles and handrails			✓		
Lip around edge of each foot pedal EN957 Part 8 – only front/sides	✓	✓	✓	✓	✓
Visual feedback about performance at the end of the workout				✓	✓
Hand rails accessible to ensure that users are able to actively support their torso during activity	✓				

Stairclimbers and Steppers

Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learni Disabi
Dependent stepping action (i.e. no involuntary movement of the stepping surface when stepping onto the equipment)			✓		
Auditory feedback about performance at the end of the workout			✓		✓
Foot straps available to stop users feet from falling off the pedals		✓			
Hand rails accessible to ensure that users are able to actively support their torso during activity		✓			
Bilateral access for transfer from a mobility aid		✓			

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Cross Trainers and Elliptical Trainers

Essential	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learni Disabi
Visible contrast between the training surface and the casing			✓		✓
Definite colour contrast on handles and handrails			✓		
Lip around edge of each foot pedal EN957 Part 9 – only front/sides	✓	✓	✓	✓	✓
Visual feedback about performance at the end of the workout				✓	✓
Hand rails accessible to ensure that users are able to actively support their torso during activity	✓				

Cross Trainers and Elliptical Trainers

Desirable	Upper Body Impairment	Lower Body Impairment	Visual Impairment	Hearing Impairment	Learni Disabi
Auditory feedback about performance at the end of the workout			✓		✓
Dependent stepping action (i.e. no involuntary movement of the stepping surface when stepping onto the equipment)			✓		
Bilateral access for transfer from a mobility aid		✓			
Hand rails accessible to ensure that users are able to actively support their torso during activity		✓			

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IFI Contact Details

Members of the IFI Equipment Panel 2001 onwards:

Will Behenna	IFI Regional Co-ordinator & User Representative
Sue Catton	IFI National Director
Howard Davies	BSI UK Representative – EN 957 Standards Committee
Spencer Holmes	IFI Co-ordinator YMCA Fit (2001 – 2003) & Fitness Practitioner
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Appendix H: Example of supplementary test description and testers' questionnaire including examples of completed items

EFDS INCLUSIVE FITNESS INITIATIVE
Test 1 – Ease of use of weight pin

Tester Number	
Test Number	**1**
Test Objective	**Ease of use of weight pin**
Test Equipment	**Pink Zone – Equipment A** **Weight pins A, B, C, D, E**

Please circle your answer:

When facing the weight stack.........

Pin A

How easy was pin A to grip?	**Easy**	**Average**	**Difficult**
Did you experience any discomfort?	**Yes**	**No**	

If yes, please explain...

Pin B

How easy was pin B to grip?	**Easy**	**Average**	**Difficult**
Did you experience any discomfort?	**Yes**	**No**	

If yes, please explain...

Pin C

How easy was pin C to grip?	**Easy**	**Average**	**Difficult**
Did you experience any discomfort?	**Yes**	**No**	

If yes, please explain...

Pin D How easy was pin D to grip? Easy Average Difficult

Did you experience any discomfort? Yes No

If yes, please explain…

Pin E How easy was pin E to grip? Easy Average Difficult

Did you experience any discomfort? Yes No

If yes, please explain…

Which pin was easiest to use? A B C D E

Please explain why…

What would make this even easier for you to use?

Which pin was most difficult to use? A B C D E

Please explain why…

Other comments, problems or suggestions

Please complete the following questions with the weight stack on your right……

When the weight stack is on your right.........

Pin A How easy was pin A to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...

Pin B How easy was pin B to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...

Pin C How easy was pin C to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...

Pin D How easy was pin D to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...

Pin E How easy was pin E to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...

Which pin was easiest to use? **A B C D E**

Please explain why…
What would make this even easier for you to use?

Which pin was most difficult to use? **A B C D E**

Please explain why…

Other comments, problems or suggestions

EFDS INCLUSIVE FITNESS INITIATIVE
Test 1 Description

Test Number:	**1**

Test Objective:	**Ease of use of weight pin**

Test Equipment:	**Pink Zone - Equipment A**

Test Description:	• Position the chair or your wheelchair to face the weight stack and put the weight pin in the heaviest weight. • Find and remove the pin then place it in the top half of the weight stack. • Find and remove the pin then place it in the bottom half of the weight stack. • Repeat for each weight pin and fill in the questionnaire. • Turn the chair or your wheelchair through 90 degrees so that the weight stack is on your right hand side when seated. • Repeat the test as above.

EFDS INCLUSIVE FITNESS INITIATIVE
Test 1 – Ease of use of weight pin

Tester Number	710
Test Number	1
Test Objective	Ease of use of weight pin
Test Equipment	Pink Zone – Equipment A Weight pins A, B, C, D, E

Please circle your answer:

When facing the weight stack.........

Pin A How easy was pin A to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain... Can't close all of my fingers

Pin B How easy was pin B to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain... Can't close all of my fingers

Pin C How easy was pin C to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain... To small couldn't grip

Pin D How easy was pin D to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain… Easy to grip

Pin E How easy was pin E to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain… not enough bulk

Which pin was easiest to use? A B C D E

Please explain why… Bulky enough to grip
What would make this even easier for you to use? I find this one fine

Which pin was most difficult to use? A B C D E

Please explain why… Not enough bulk to grip

Other comments, problems or suggestions

Most of handles do not have enough bulk to grip as I cant close all of my finger

Please complete the following questions with the weight stack on your right……

When the weight stack is on your right.........

Pin A How easy was pin A to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain... Big enough to grip

Pin B How easy was pin B to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain... Big enough to grip

Pin C How easy was pin C to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain... To small no bulk to grip

Pin D How easy was pin D to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain... Perfect for me plenty of bulk to hold on to

Pin E How easy was pin E to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain... Totally uncomfortable not enough bulk

Which pin was easiest to use? A B C D E

Please explain why… Plenty of bulk to grip
What would make this even easier for you to use? perfect for me

Which pin was most difficult to use? A B C D E

Please explain why… to small no bulk to grip as I cant close all of my fingers

Other comments, problems or suggestions

Most of them do ~~&~~ not have enough bulk to grip as I cant close all of my fingers

EFDS INCLUSIVE FITNESS INITIATIVE
Test 1 – Ease of use of weight pin

INCLUSIVE FITNESS

Tester Number	9506
Test Number	**1**
Test Objective	**Ease of use of weight pin**
Test Equipment	**Pink Zone – Equipment A** **Weight pins A, B, C, D, E**

Please circle your answer:

When facing the weight stack.........

Pin A **How easy was pin A to grip?** **Easy** **Average** **Difficult**
Did you experience any discomfort? **Yes** **No**

If yes, please explain...
Smooth, large enought to get a good hold of. Comfortable

Pin B **How easy was pin B to grip?** **Easy** **Average** **Difficult**
Did you experience any discomfort? **Yes** **No**

If yes, please explain...
Didn't fit the weight stack. OK but not as easy to pull as others.

Pin C **How easy was pin C to grip?** **Easy** **Average** **Difficult**
Did you experience any discomfort? **Yes** **No**

If yes, please explain...
A bit uncomfortable having the attachment strap looped around the pin handle – all too small

Pin D How easy was pin D to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...
OK but not particular easy to grip (small + no ~~'edge'~~ 'lip' to get fingers around. Too short

Pin E How easy was pin E to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

~~Not~~ E

If yes, please explain...
Very sharp.

Which pin was easiest to use? A B C D E

Please explain why...
Easiest to grip. Smoothest to grip. Good leverage due to lip
What would make this even easier for you to use? Easier if the adjustment strap ring were attached somewhere else rather than on the knob/handle where you grip

Which pin was most difficult to use? A B C D E

Please explain why...
Small, miniature, not easy to get a good hold of + lack of space from adjustment strap ring.

Other comments, problems or suggestions

Please complete the following questions with the weight stack on your right......

No different from front onwards

When the weight stack is on your right.........

Pin A How easy was pin A to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...

Same as front

Pin B How easy was pin B to grip? ~~Easy~~ Average Difficult
Did you experience any discomfort? ~~Yes~~ No

If yes, please explain...

Same

Pin C How easy was pin C to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...

Same

Pin D How easy was pin D to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...

Same

Pin E How easy was pin E to grip? Easy Average Difficult
Did you experience any discomfort? Yes No

If yes, please explain...

Same

Which pin was easiest to use? A B C D E

Please explain why…

Same as front-on

What would make this even easier for you to use?

Which pin was most difficult to use? A B C D E

Please explain why…

Too short, no real place to get a good grip / leverage

Other comments, problems or suggestions

Appendix I: Excerpt from inclusive design standard (IFI Equipment Standard – Stage 2, Part 1 – General Requirements and Part 2 – Strength Equipment)

Part 1 – General Requirements

Introduction

Part 1 of the IFI Equipment Standard – Stage Two specifies the general requirements that are applicable to all equipment. Where there are additional equipment specific Requirements, which are detailed in Parts 2 to 9, the Requirements of the specific Part take precedence over any corresponding Requirements of Part 1 General Requirements. However individual Parts must always be applied in conjunction with Part 1 General Requirements.

The IFI Equipment Panel will not accredit any exercise equipment that does not comply with the relevant Parts of BSEN 957 Stationary Training Equipment. Where appropriate, equipment must also meet the relevant Electromagnetic Compatibility (EMC) and Low Voltage Directive (LVD) requirements. Documentary evidence must be supplied to verify compliance.

The Requirements of the IFI Equipment Standard – Stage Two, apply to all equipment that falls within the scope of BSEN 957 - Part 1 General safety requirements and test methods. Any equipment falling outside of the scope of BSEN 957 – Part 1 must meet Part 1 of the IFI Equipment Standard – Stage Two, any other Parts that apply and any relevant European Directives.

1.1. Access and Set Up

Req. No	Title	Standard	Method of Verification
1.1.1	Access and Transfer	The frame and other structural parts of the equipment shall not interfere with easy transfer and access onto or egress from the equipment. The equipment shall be capable of being accessed from the maximum number of approach angles as practical. The equipment shall require a minimum range of movement and co-ordination from the user to allow access to and egress from the equipment.	VE PT PT
1.1.2	Step-on Height	The maximum step-on height to the operational surface shall be no higher than 170 mm, measured vertically from the ground when in the lowest start position to the highest point the foot has to clear to allow access. Where the step-on height exceeds 170mm, a step or steps must be provided to reduce the height to 170mm or less*. The maximum height of each individual step shall not exceed 170mm. The IFI Equipment Panel reserve the right not to accredit products that require more than two steps to access the equipment, depending on the nature of the exercise or the equipment.	DC VE

1.1.3	Maximum Starting Settings	Unless stated in the relevant Part of the Standard, a low start speed (or equivalent) must be available for machine-driven equipment. This will be at the discretion of the IFI Equipment Panel based on user feedback.	PT
1.1.4	Maximum Increments	A low speed increment (or equivalent) must be available for machine-driven equipment. This will be at the discretion of the IFI Equipment Panel based on user feedback.	PT

1.2. Seats

Req. No	Title	Standard	Method of Verification
1.2.1	Seat Height – Upper Body Equipment	Unless specifically advised in the relevant Part of the Standard, all upper body exercise equipment for which a seat is provided must have an adjustable height seat which adjusts to a point within the range of 350mm to 550mm measured vertically from the ground to the highest point of the seat.	PT DC
1.2.2	Seat Height – Lower Body Equipment	Where the seated exercise height on lower body exercise equipment exceeds 450mm measured vertically from the ground to the highest point of the seat when set at its lowest position, a step or steps must be provided to reduce the height to	PT DC

		450mm or less*. The maximum height of each individual step shall not exceed 170mm. The IFI Equipment Panel reserve the right not to accredit products that require more than two steps to access the equipment, depending on the nature of the exercise or the equipment.	
1.2.3	Re/Moveable Seats	Unless specifically advised in the relevant Part of the Standard, all upper body exercise equipment for which a seat is provided must allow the seat to be re/moved to permit users to exercise from their wheelchair. When the seat is re/moved the remainder of the equipment must be sufficiently stable to permit normal, safe use.	PT
1.2.4	Clearance	Once the seat is re/moved, the remaining area must be free of physical obstructions above the height of 15mm measured vertically from the ground to allow a wheelchair user to adopt a stable and safe exercise position.	DC
1.2.5	Movement	All re/moveable seats must have an appropriate mechanism (e.g. wheels or skids) to enable the seat to move easily over different floor surfaces.	PT VE
1.2.6	Safe Operation	Re/moveable seats must be capable of allowing safe operation when positioned for use, i.e. wheels or similar must be disengaged or a locking mechanism provided to prevent unintentional movement.	VE PT

1.2.7	Movement - Weight	Re/moval of the seat must not require the user to lift the seating arrangement, unless the seating arrangement weighs less than 7.5kgs.	PT DC
1.2.8	Alignment	Where the exercise movement path is defined by the equipment (e.g. fixed resistance equipment), re/moveable seats that are not fixed to the equipment must have a visual reference to ensure the correct seat alignment and position of the user when performing the primary exercise.	VE PT
1.2.9	Seat Dimensions	Unless specifically advised in the relevant Part of the Standard, where seats are provided for use during exercise they shall have a minimum width (at the widest point in the hip/pelvic area where the user is being supported) of 380mm and a minimum depth (at the centre line) of 254mm.	DC
1.2.10	Back Rest – Operation	Where back rests are provided they must not free fall when being adjusted.	PT

1.3. Handles

Req. No	Title	Standard	Method of Verification
1.3.1	Seat /Bench Handles	For seated lower body exercise equipment handles must be available in proximity to the seat or bench.	PT
1.3.2	Handle Height	Where handles are fitted in proximity to the seat or bench, the top edge of the handle shall be positioned flush or below the horizontal seat height, so as not to interfere with transfer.	VE PT
1.3.3	Handle Proximity	Where fixed handles are fitted in proximity to the seat or bench they shall have a minimum distance of 45mm and a maximum distance of 60mm measured between the outside edge of the seat and the inside edge of the handle for a minimum of 150mm of the handle length, unless seats/benches rotate to allow multiple transfer positions.	DC
1.3.4	Static Handles	Static handles or other structural components shall be provided to enable users to transfer, access and stabilise. When using the handles the equipment shall remain stable at all times.	PT

1.3.5	Movement Handles	A handle(s) must be provided in an appropriate position on Removeable seats or benches to assist ease of movement away from/replacement to the structure of the equipment.	PT

1.4. Adjustment Mechanisms

Req. No	Title	Standard	Method of Verification
1.4.1	Adjustment Mechanisms	Adjustment mechanisms shall be easy to use, insert and/or remove for users such as those with limited dexterity and/or sensory impairments.	PT TE
1.4.2	Set Up	Unless specifically advised in the relevant Part of the Standard, left or right hand bias of adjustments shall be avoided when setting up the equipment. Adjustments shall be centrally located or duplicated to avoid bias.	VE PT
1.4.3	One Hand Adjustment	Unless specifically advised in the relevant Part of the Standard, all equipment shall be capable of being set up using only one hand, either before adopting the exercise position (provided that this does not compromise ease of access) or from the exercise position. Vertical seat height and back rest adjustments are excluded from this requirement.	PT

1.4.4	Position of Seat Adjustments	The position of the seat adjustment and back rest adjustment mechanism(s) must be visible to the user on approach to the equipment and/or from the seated exercise position.	VE PT
1.4.5	Fixed Positions	Where fixed position settings are provided, these must be clearly identified with distinctive markings e.g. numbers, letters or symbols.	VE
1.4.6	Markings – Tactile	Markings must be tactile with a minimum raised height of 200 microns, but ideally 400 microns, except where there is an interference fit where engraved or moulded in relief markings are acceptable.	VE DC TE
1.4.7	Markings –Font	Markings must be displayed in a clear sans serif font.	VE
1.4.8	Markings –Size	The minimum height of any markings shall be 15mm. Only if the dimension of the position settings precludes this may they be smaller in which case they must be no less than 10mm in height.	VE DC

1.5. Colour Contrast

Primary Components - Equipment - Colour contrast for Primary Components is defined as a colour difference equal to or greater than 320, and a brightness difference equal to or greater than 100 against their stated Background Feature.
Primary Components - Instructions- Colour contrast for Primary Components is defined as a colour difference equal to or greater than 400, and a brightness difference equal to or greater than 125 against there stated Background Feature.

Secondary Components - Equipment – Colour contrast for Secondary Components is defined as a colour difference of greater than 240 but less than 320, and a brightness difference of greater than 68 but less than 100 against their stated Background Feature.
Secondary Components - Instructions – Colour contrast for Secondary Components is defined as a colour difference of greater than 300 but less than 400, and a brightness difference of greater than 85 but less than 125 against their stated Background Feature.
Where Secondary Component colour contrast is stated this is a minimum requirement, but a Primary Component level of colour contrast is also acceptable.

Verification – The algorithm to verify colour and brightness differences is available on the IFI web site www.inclusivefitness.org/equipment.

Req. No	Title	Standard	Method of Verification
1.5.1	Seat/Bench Upholstery	Seat upholstery (Secondary Component) shall have the required colour contrast with the frame (Background Feature). This may mean that a number of combinations of coloured upholstery and frame will not be permitted under IFI accreditation.	CCV
1.5.2	Handles and Hand Cranks	Handles/hand cranks (Secondary Components) shall have an appropriate element of the required colour contrast with the frame or the surrounding part of the equipment when seen from the primary angle of approach (Background Feature).	CCV VE
1.5.3	Pedal/Foot Straps	Pedal/foot straps (Primary Components) must have the required colour contrast with the foot pedals (Secondary Component).	CCV
1.5.4	Adjustment Mechanisms	Adjustment mechanisms (Primary Components) shall have the required colour contrast to the frame or the surrounding part of the equipment when seen from the primary angle of approach (Background Feature).	CCV VE
1.5.5	Tactile Numbering and Markings	Tactile numbering and markings (Primary Component) shall have the required colour contrast with the frame or the surrounding part of the equipment when seen from the primary angle of use (Background Feature) The IFI Equipment Panel reserve the right to waive this requirement where an	CCV

		interference fit and hence the use of engraved or moulded in relief markings are unavoidable.	
1.5.6	Instruction Panels and Labels	A minimum of the edge or border of each main instruction panel/label (Primary Component) shall have the required colour contrast from the surface it is sited on (Background Feature).	CCV
1.5.7	Instructional Text	Text used on main instruction panels/labels (Primary Component) shall have the required colour contrast from the material it is printed on (Background Feature).	CCV
1.5.8	Instructional Graphics	Graphics used on any main instruction panels/labels (Primary Component) shall have the required colour contrast from the material they are printed on (Background Feature).	CCV

1.6. Instructions for Use

Req. No	Title	Standard	Method of Verification
1.6.1	Positioning	The main instruction panel(s) shall be positioned fully (excluding borders) within the range 700mm – 1500mm above the ground.	DC

1.6.2	Specific Components	Where structure permits, instructions and/or labels relating to specific equipment components must be placed within 400mm of the component described measured between the closest two points.	VE DC
1.6.3	Sight Line	Where structure permits, instructions and/or labels must be within the clear line of sight of the user when in the exercise position.	PT
1.6.4	Materials	The material(s) used for the instruction panel(s) must be heavy enough to prevent 'show through' of housing details such as seams or fixings.	VE
1.6.5	Finishes	Instructions must be printed on a matt or non-glare finish.	VE
1.6.6	Font Style	Sans serif fonts shall be used for main headings and body text elements of the instruction panel(s). Serif fonts shall only be incorporated within marketing elements such as core branding and logo artwork/graphics.	VE
1.6.7	Font Size	The actual printed text shall be a minimum height of 2mm for the smallest letter (in lower case), (circa) 12-14 point size depending on the font style used.	DC
1.6.8	Text Alignment	All text shall be aligned left and unjustified and shall remain horizontal without flowing around graphic elements or images except core branding and logo artwork/graphics.	VE

1.6.9	Word Spacing	The spacing between words shall be increased by a minimum of 20% from standard font spacing except core branding and logo artwork/graphics.	VE DC
1.6.10	Character Spacing	The spacing between characters within a word shall be increased by a minimum of 20% from the standard font spacing except core branding and logo artwork/graphics.	VE DC
1.6.11	Line Spacing	The spacing between lines shall be a minimum of 1.5 times the standard font space between the words on a line except core branding and logo artwork/graphics.	DC
1.6.12	Text Style	Capitalised words must not be used except as core branding or logo artwork/graphics.	VE
1.6.13	Graphic Diagrams	Where instructions for use are depicted graphically, they must show a start and an end exercise position.	VE
1.6.14	Arrows	If an arrow is used to provide direction to a specific component then the arrow must be positioned in between the instructions and the component, with the arrow pointing to the component.	VE

1.6.15	Alternative Formats	Instructions for use reflecting the above Requirements must be provided for users in an accessible electronic format, e.g. a CD-Rom with documents in Microsoft Word format.	VE
1.6.16	Technical Manuals	Good practice and training manuals reflecting the above Requirements, (except 1.6.9 Word Spacing and 1.6.10 Character Spacing) must be provided for disabled instructors in an accessible electronic format, e.g. CD Rom with documents in Microsoft Word format.	VE

1.7. Consoles

Req. No	Title	Standard	Method of Verification
1.7.1	Console	The console controls must meet the Requirements of Part 4 – Consoles of the IFI Equipment Standard – Stage Two.	

Part 2 – Strength Equipment

Introduction

Part 2 of the IFI Equipment Standard – Stage Two specifies Requirements that are applicable to all strength equipment. The Requirements of this specific Part take precedence over the corresponding Requirements of Part 1 General Requirements. However Part 2 must always be applied in conjunction with Part 1 General Requirements.

The IFI Equipment Panel will not accredit any exercise equipment that does not comply with the relevant Parts of BSEN 957 Stationary Training Equipment. Documentary evidence must be supplied to verify compliance.

2.1. Access and Set Up

Req. No	Title	Standard	Method of Verification
2.1.1	Adjustable / Alternative Start Position(s)	All equipment shall provide adjustable or alternative start position(s) that allow the joint(s) being used to work within a non-stressed range of motion. The range shall be capable of being pre-set before commencing the exercise or shall automatically adjust to the users size and range of motion. This includes equipment with re/moveable seats where the seat has been re/moved.	PT
2.1.2	Pre-Stretch Equipment	Upper body exercise equipment must not require the use of the lower limb(s) to achieve a non-stressed and appropriate start position.	PT
2.1.3	One Hand Adjustment	Accessories e.g. detachable alternative handles and karabiners are excluded from the one hand adjustment Requirement 1.4.3 of Part 1 – General Requirements of the IFI Equipment Standard – Stage Two.	VE
2.1.4	High Handles	Equipment where handles could be stored above 1400mm e.g. cable lat pull equipment, shall be equipped with a mechanism or storage facility that provides a fixed start position(s) with a maximum height of 1400mm measured vertically from the lowest grip point of the handle to the ground.	DC

2.1.5	Low Handles	Equipment where handles could be stored below 400mm e.g. fixed low pulleys, shall be equipped with a mechanism or storage facility that provides a fixed start position(s) with a minimum height of 400mm measured vertically from the highest grip point of the handle to the ground.	DC
2.1.6	Adjustable Pulleys – Storage Position	Equipment which has adjustable start height positions e.g. adjustable pulley equipment, outside the range of 400mm to 1400mm, must have a label to indicate the position at which the pulley must be stored at the completion of exercise. The storage height and the sign must be located within the range 900mm – 1100mm. The label must meet the Requirements 1.4.6 to 1.4.8 of Part 1 of the IFI Equipment Standard – Stage Two.	DC
2.1.7	Adjustable Pulleys – Operation	Adjustable pulley mechanisms must prevent free falling when being adjusted.	PT

2.2. Seats and Benches

Req. No	Title	Standard	Method of Verification
2.2.1	Re/Moveable Seats/Benches	All upper body exercise equipment where the movement path is defined by the equipment (e.g. fixed resistance equipment) must have a seat that meets all the Requirements of Section 1.2 Seats of Part 1 – General Requirements of the IFI Equipment Standard – Stage Two or a bench that meets all the Requirements of Section 3.2 Benches of Part 3 – Free Weight Equipment of the IFI Equipment Standard – Stage Two.	VE
2.2.2	Re/Moveable Benches	All upper body exercise equipment for which a bench is provided must allow the bench to be re/moved to permit users to exercise from their wheelchair. When the bench is re/moved the remainder of the equipment must be sufficiently stable to permit normal, safe use.	PT
2.2.3	Movement - Weight	Where a bench is provided, movement of the bench must not require the user to lift the bench arrangement to move it, unless the bench arrangement weighs less than 7.5kgs.	PT DC

2.2.4	Bench Clearance	Where a bench is provided, once the bench is re/moved, the remaining area must be free of physical obstructions above the height of 15mm measured vertically from the ground to allow a wheelchair user to adopt a stable and safe exercise position.	DC
2.2.5	Bench Alignment	Where a bench is provided and where the exercise movement path is defined by the equipment (e.g. fixed resistance equipment), re/moveable benches that are not fixed to the equipment must have a visual reference to ensure the correct bench alignment and position of the user when performing the primary exercise.	VE PT
2.2.6	Back Rest	All exercise equipment requiring pressing and pushing movements where the movement path is defined by the equipment (e.g. fixed resistance equipment) must have an integral back rest to the seat/bench.	VE
2.2.7	Additional Support	All exercise equipment requiring seated pulling movements where the movement path is defined by the equipment (e.g. fixed resistance equipment) must have a chest pad, knee restraint or similar method of stabilising the user.	VE

2.3. Handles

Req. No	Title	Standard	Method of Verification
2.3.1	Stability Handles	When exercising unilaterally, handle(s) must be provided to allow the user to stabilise their position where the exercise movement path is defined by the user (e.g. cable and pulley equipment), or where the user is not stabilised in any other way. The IFI Equipment Panel reserve the right to determine where stability handles are required based on user feedback.	VE PT
2.3.2	Length	Where stability handle(s) are required they shall have a minimum length of 150mm.	DC
2.3.3	Height Position	Where stability handle(s) are required they shall be available at least at a height of 700mm (for seated users) and 1250mm (for standing users) measured from the bottom of the handle grip to the ground unless user feedback indicates otherwise (see Requirement 2.3.1 above). A single continuous handle covering this dimension range is acceptable.	DC
2.3.4	Accessibility	Where stability handle(s) are provided they shall be easily accessible from the main exercise position(s).	DC

2.4. Adjustment Mechanisms

Req. No	Title	Standard	Method of Verification
2.4.1	Handle Attachment Mechanisms	Methods for attaching removeable handles shall be easy to operate for users such as those with limited dexterity and or sensory impairments. Where karabiners are used these shall be bent gate offset D.	VE PT

2.5. Colour Contrast

Req. No	Title	Standard	Method of Verification
2.5.1	Colour Contrast	Strength equipment must meet the Requirements of Section 1.5, Colour Contrast of Part 1 – General Requirements of the IFI Equipment Standard – Stage Two.	
2.5.2	Adjustment Mechanisms	Karabiners or other mechanisms for attaching removeable handles (see Requirement 2.4.1 above) are not required to have the colour contrast stipulated in Requirement 1.5.4 Adjustment Mechanisms of Part 1 – General Requirements of the IFI Equipment Standard – Stage Two.	

2.6. Instructions for Use

Req. No	Title	Standard	Method of Verification
2.6.1	Instructions for Use	Instructions for use must be placed on fixed resistance equipment and (except where otherwise specified above i.e. weight stack numbering) must meet the Requirements of Section 1.6, Instructions for Use of Part 1 – General Requirements of the IFI Equipment Standard – Stage Two.	VE

2.7. Weight Stack

Req. No	Title	Standard	Method of Verification
2.7.1	Weight Stack Numbering System	Only one weight stack numbering system must be used, e.g. kgs or lbs or numerical increments.	VE
2.7.2	Tactile Numbers/	Weight stack numbers, iconography and or letters shall be tactile and have a minimum raised height of 200 microns, but ideally 400 microns. Identification of the	DC

	Iconography/ Letters	weight denomination (e.g. kgs or lbs) in tactile lettering is not required.	
2.7.3	Font Style of Numbers	The weight stack numbers must be displayed in a clear sans serif font.	VE
2.7.4	Font Size of Numbers	The minimum height of the weight stack numbers shall be 15mm. Only if the thickness of the weight plates precludes this may they be smaller in which case they must be no less than 10mm in height.	DC
2.7.5	Position of Numbers	The weight stack numbers must be located on the weight stack itself or on the weight guards.	VE
2.7.6	Numbering Proximity	The weight stack numbers shall not be further than 100mm from the relevant weight selection hole or method of selection unless a raised arrow or similar raised iconography is provided to allow the user to navigate easily from the raised number to the appropriate weight selection point or similar on the equipment.	DC
2.7.7	Arrows	Where a tactile arrow is used this must be located on the same side of the weight stack as the weight stack number and point toward the weight selection location. It must align directly with the weight to which it actually refers.	VE DC

2.7.8	Incremental/ Half Weights	Incremental or half weight systems must be labelled with tactile numbers with a minimum height of 10mm in a clear sans serif font. Where space does not permit this, iconography or letters may be substituted for numbers with the same minimum height. Where there is an interference fit engraved or moulded in relief iconography, letters or numbering is acceptable. The IFI Equipment Panel reserve the right to determine suitable tactile labelling based on user feedback.	TE DC
2.7.9	Braille	Braille numbering must not be used as a substitute for tactile numbers/letters but may be added in addition.	VE
2.7.10	Start Weights and Increments	All equipment shall have a low start weight appropriate to the exercise being performed measured using a spring balance attached to the handle, footplate or other attachment where the user exerts force. The start weight shall be the lowest operational weight on the weight stack. If there are adjustable hand or foot positions the middle position shall be the point at which measurements shall be taken. Where more than one hand or foot position is available, measurements will be made at all positions and the average resistance calculated. The weights listed below represent those intended for use in bilateral exercise, unless stated otherwise.	PT DC

Functionality	Examples	Max. Start Weight	Max. Incremental Weight
Upper Body			
Horizontal pressing and pulling movements	Chest press, seated row	7.5kgs	5kgs
Overhead pressing movements	Shoulder press	5kgs	2.5kgs
Pull down or push down movements	Lat pull, triceps push	5kgs	2.5kgs
Rotational equipment of elbow or shoulder	Bicep curl, lateral raise	5kgs	2.5kgs
Lower Body			
Horizontal pressing movements	Leg press	20kgs	10kgs
Vertical pressing movements	Squat, hack squat	15kgs	5kgs
Rotational movements of hip, knee or ankle	Leg extension/leg curl, hip abductor/adductor	5kgs	2.5kgs
Trunk / Torso			
All trunk movements	Flexion/extension/rotation	5kgs	2.5kgs
Cable Equipment	User defined movements		
Unilateral movements		2.5kgs	2.5kgs
Bilateral movements	Two handed cable crossover	5kgs	2.5kgs

2.7.11	Maximum Weight	All exercise equipment shall have an appropriate maximum weight. The IFI Equipment Panel reserves the right to reject items of equipment with low or inappropriate maximum weights.	PT DC
2.7.12	Weight Selection Position	All weight stack selection pins shall be capable of being accessed by the user on approach to the equipment prior to the commencement of exercise or from the main exercise position(s).	PT
2.7.13	Weight Selection Pin	The weight pin must have a structural element that enables the user to remove the pin without the need to grip the pin fully.	VE TE & PT
2.7.14	Tether	Where a pin or similar method is used to select the weights, it must be tethered to the structure of the weight stack and must not interfere with the operation of the weights or the use of the pin.	VE PT
2.7.15	Weight Pin Security	A locking key weight selection mechanism must be available.	PT

Appendix J: Feedback questionnaire for design teams including examples of completed items

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards – Stage Two"

Feedback Questionnaire for Design Teams

Dear Supplier,

Thank you for agreeing to provide feedback on the IFI Equipment Standard – Stage Two. Your participation is valued and your input will help to influence future standards development in the field of inclusive design.

The questionnaire to be completed is presented below. Please be as open and honest with your answers as possible.

A small number of extracts from completed questionnaires may be quoted within the submitted research thesis. All comments will be used anonymously. Your name, company name or any specific product names mentioned will be kept confidential and will not be quoted.

If you have any questions, concerns or require any further information about the questionnaire, or you do not consent to your feedback being used in the submitted research thesis, please do not hesitate to contact me - dawn@inclusivefitness.org or +44(0)114 257 2060.

I would like to take this opportunity to thank you for your involvement throughout the project and I look forward to working with you again in the future.

Kind regards,

Dawn Hughes

IFI Equipment Research Manager
Inclusive Fitness Initiative
&
Researcher
Sheffield Hallam University

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards – Stage Two"

Feedback Questionnaire for Design Teams

Background Information

The IFI Equipment Standard – Stage Two was developed to assist the commercial fitness equipment industry to design products that better meet the needs of disabled people.

The aim of this questionnaire is to gain feedback from the industry about whether the standard has been an effective means to support designers in adopting inclusive design practices for fitness equipment.

It is most likely that your use of the IFI Equipment Standard – Stage Two was as part of the "IFI Accreditation" process. Please note that this questionnaire is currently seeking feedback on the equipment standard only – the fact that it exists, whether it offers new design information, and whether it helped you to design products more inclusively?

If you wish to give feedback on the wider "IFI Accreditation" process (e.g. the practical assessment process, sending evidence for compliance, issuing of logos and marketing material, etc) please provide this in a separate email communication.

Respondent Information

(Please Note: collected for monitoring purposes only, will not be released publically)

Name:

Organisation:

Job Title:

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards – Stage Two"

Feedback Questionnaire for Design Teams

Question 1

1. Has the IFI Equipment Standard – Stage Two been useful to you in incorporating inclusive principles into the design of your equipment?

Yes No

Please explain . . .

Question 2

2. Did you previously have access to the type of inclusive design information contained within the standard?

Yes No

If Yes, please give source . . .

If No, how long would it take you to develop, and how would you go about obtaining, this kind of information yourself?

Feedback Questionnaire for Design Teams

Question 3

3. How did you undertake inclusive design before you had access to this standard?

Question 4

4. Do you intend to use the information contained within the standard in the future?

Yes No

Please explain . . .

inclusive fitness

Feedback Questionnaire for Design Teams

Question 5

5. Have you had any feedback (positive or negative) on the inclusive features of products designed to the standard?

Yes No

Please give brief details (confidentiality is assured) . . .

Further Comments

Any further comments you would like to provide on the standard...?

Thank you for providing feedback on the IFI Equipment Standard - Stage Two.

Please return your completed questionnaire to:

Ms Dawn Hughes
IFI Equipment Research Manager
dawn@inclusivefitness.org

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards - Stage Two"

Feedback Questionnaire for Design Teams

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If you wish to give feedback on the wider "IFI Accreditation" process (e.g. the practical assessment process, sending evidence for compliance, issuing of logos and marketing material, etc) please provide this in a separate email communication.

Respondent Information

(Please Note: collected for monitoring purposes only, will not be released publically)

Name: [redacted]

Organisation:

Job Title: Director Quality

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards – Stage Two"

Feedback Questionnaire for Design Teams

Question 1

1. Has the IFI Equipment Standard – Stage Two been useful to you in incorporating inclusive principles into the design of your equipment?

✓ Yes No

Please explain . . .

Good set up. Presents standards in a way that allows designers to use info, example: distances, clearances.

Question 2

2. Did you previously have access to the type of inclusive design information contained within the standard?

Yes ✓ No

If Yes, please give source . . .

If No, how long would it take you to develop, and how would you go about obtaining, this kind of information yourself?

It would not have been pursued.

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards - Stage Two"

inclusive fitness

Feedback Questionnaire for Design Teams

Question 3

3. How did you undertake inclusive design before you had access to this standard?

Stage I and Stage II are the only exposure [redacted] has had w/ inclusive design.

Question 4

4. Do you intend to use the information contained within the standard in the future?

✓ Yes No

Please explain . . .

The IFI set up in U.K. has created the need to include IFI products to do business and it is now part of the business plan.

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards - Stage Two"

Feedback Questionnaire for Design Teams

Question 5

5. Have you had any feedback (positive or negative) on the inclusive features of products designed to the standard?

✓ Yes   No

Please give brief details (confidentiality is assured) . . .

In general positive feedback. The IFI requirements work ~~&~~ more people can use equipment.

Further Comments

Any further comments you would like to provide on the standard...?

Please move toward Stage III when it is ready, not to just meet a time frame.

Thank you for providing feedback on the IFI Equipment Standard - Stage Two.

Please return your completed questionnaire to:

Ms Dawn Hughes
IFI Equipment Research Manager
dawn@inclusivefitness.org

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards – Stage Two"

Feedback Questionnaire for Design Teams

Background Information

The IFI Equipment Standard – Stage Two was developed to assist the commercial fitness equipment industry to design products that better meet the needs of disabled people.

The aim of this questionnaire is to gain feedback from the industry about whether the standard has been an effective means to support designers in adopting inclusive design practices for fitness equipment.

It is most likely that your use of the IFI Equipment Standard – Stage Two was as part of the "IFI Accreditation" process. Please note that this questionnaire is currently seeking feedback on the equipment standard only – the fact that it exists, whether it offers new design information, and whether it helped you to design products more inclusively?

If you wish to give feedback on the wider "IFI Accreditation" process (e.g. the practical assessment process, sending evidence for compliance, issuing of logos and marketing material, etc) please provide this in a separate email communication.

Respondent Information

(Please Note: collected for monitoring purposes only, will not be released publically)

Name: [redacted]

Organisation:

Job Title: UK Service Manager

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards – Stage Two"

Feedback Questionnaire for Design Teams

Question 1

1. Has the IFI Equipment Standard – Stage Two been useful to you in incorporating inclusive principles into the design of your equipment?

✔ Yes No

Please explain . . .

I am the [redacted] UK IFI representative, not directly part of the [redacted] design team. However I am responsible for either ensuring [redacted] products are designed in the [redacted] to meet the needs of the IFI, or to modify machines locally within the UK to meet IFI requirements.
The Stage 2 standards have allowed me to identify in detail the needs of the IFI standards. The more detailed the standard the less room for interpretation.
Where the products have had to be modified locally in the UK (albeit as a short term measure) the document has been (and continues to be) very useful as a working document to carry out the changes.
By having the standard in advance it enables the design teams in the [redacted] to build the requirements into their requirement specs., allowing them to appreciate the IFI needs and build this in as a philosophy rather than a burden.

Question 2

2. Did you previously have access to the type of inclusive design information contained within the standard?

✔ Yes No

If Yes, please give source . . .

The only previous experience of IFI requirements was the Stage 1 standards, other than this, then no previous information was available.

If No, how long would it take you to develop, and how would you go about obtaining, this kind of information yourself?

Without the information supplied as part of the IFI process, the resources within the UK office would seriously inhibit such a standard or anything approaching it from being developed.
Initially, it would likely be to employ consultancy resource to carry out this project, no doubt as an expensive exercise.

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards – Stage Two"

Feedback Questionnaire for Design Teams

Question 3

3. How did you undertake inclusive design before you had access to this standard?

Other than Stage 1 information, no inclusive design was undertaken.

Question 4

4. Do you intend to use the information contained within the standard in the future?

✔ Yes   No

Please explain . . .

The most important legacy of the standard is to continue to encourage design teams to 'think inclusive' when designing products, not to consider it as an add-on for a special version of the machine, but for the 'standard' machine to become the 'inclusive' machine.

Within [redacted] have noticed over the years of being involved with the IFI standards how less changes are required to the standard product to meet the IFI needs - this is a positive indication that the 'inclusive needs' are becoming a 'design need' rather than an afterthought.

Inclusive Design Standard for Commercial Fitness Equipment
"IFI Equipment Standards - Stage Two"

Feedback Questionnaire for Design Teams

Question 5

5. Have you had any feedback (positive or negative) on the inclusive features of products designed to the standard?

✔ Yes No

Please give brief details (confidentiality is assured) . . .

Most of the issues have been internal, where designers, sales people questioned the need for some of the requirements. This was mainly due to not thinking about the disabled population as a whole and all the varied disabilities this encompasses.
Once explained, this better understanding was then more widely accepted and the spirit of 'inclusivity' became an asset rather than a hindrance.

Further Comments

Any further comments you would like to provide on the standard...?

Over the 6+ years that I have been involved with the IFI, it is clear that where such standards have been developed, the initial view of allowing manufacturers to have a certain amount of freedom so as not to over-influence the aesthetics of each product, this changed to a need, mainly driven by the manufacturers for the standards to be more prescriptive in order for better consistence across all manufacturers products.

Thank you for providing feedback on the IFI Equipment Standard - Stage Two.

Please return your completed questionnaire to:

Ms Dawn Hughes
IFI Equipment Research Manager
dawn@inclusivefitness.org