Association for Science Education

Design of Science Accommodation in Special Schools

During the research phase of LDTL project, several members of NAIGS asked for support in designing laboratories for special schools. This overview represents what is available at present. It aims to give science advisers / inspectors / consultants an introduction to the area of design of science accommodation for pupils with a range of special educational needs.

The design of specialist spaces within special schools is not well developed and the DfES are actively looking into this. At the time of writing, the most that is available is a combination of mainstream specialist advice and special school advice, coupled with an understanding of the range of needs of the pupils who go to special schools.

Introduction

Major efforts have been made over many years to integrate pupils with special educational needs into mainstream education. Advances in technology have also helped; for example, new hearing aids and cochlea implants have meant many hearing-impaired pupils transferring to mainstream schools. Though it is difficult to generalise, those who remain in special schools tend to be those with the more severe disabilities, or multiple disabilities, and/or severe behavioural problems; those requiring highly specialist support.

Sources of advice available

Mainstream science provision:

Laboratory Design for Teaching and Learning project , www.ase.org.uk/ldtl

Science Accommodation in Secondary Schools, Building Bulletin 80 (revised 2004), DfES, from www.ase.org.uk/ldtl or www.teachernet.gov.uk

Designing and Planning Laboratories, Guide L14, CLEAPSS, from www.ase.org.uk/ldtl or www.cleapss.org.uk

Special School advice:

Designing for Pupils with Special Educational Needs – Special Schools, Building Bulletin 77, DfES
and Phase 1 Research Work for Building Bulletin 77 update , from www.dfes.gov.uk with an e-consultation due out in autumn 2004

Acoustic Design of Schools: A Design Guide, Building Bulletin 93, DfES, especially Section 6 ‘Acoustic design and equipment for pupils with special hearing requirements’

Inclusive School Design; Accommodating pupils with special educational needs and disabilities in mainstream schools, Building Bulletin 94, DfES

Exploring Access, Royal National Institute for the Blind. This is a 247 page photocopiable resource, but the information pages are very useful (totalling some 30 pages)

Science for Secondary-aged Pupils with Special Educational Needs CLEAPSS Guide L77. This also contains an extensive list of organisations that offer further advice and support.

Is a laboratory needed?

Where the curriculum does not reach into Key Stage 3, it is doubtful whether a laboratory is needed. A practical space, with tables and some services, that is part of an ordinary classroom, might well suffice; similar to the division between primary and secondary in mainstream education.

However, where Key Stage 3 through to Key Stage 4 work is envisaged then laboratory provision of some kind will be needed. The updated BB77 is likely to include a recommendation for 'a designated specialist teaching space for science at secondary … of 65m^2'. Special schools tend to be all-though age schools and pupils need to be able to see that they are moving from one part of their schooling to more 'grown-up' provision (the laboratory) as part of their progression to adult-hood and in developing life-skills.

If an adviser/inspector/consultant is called into a school to 'design a science lab', the school will already have decided that their pupils need to be learning in this part of the curriculum, but it is worth exploring this before proceeding with discussion on actual designs. Frequently in special schools, the science 'specialist' may well teach other subjects as well and be daunted by being faced with designing a laboratory. On the other hand they will be very well versed in the needs of the children they teach.

The pupils

Where pupils have the more severe disabilities, design of the science area will need extra consideration. Those with severe physical difficulties may have specially built wheel-chairs, some being nearly beds, and need alternative chairs and desks for different activities. Some pupils may need to work from cushions on the floor for some of the time. Pupils may be almost permanently on supplementary oxygen supplies, may need to drink or eat at an instant's notice, or may be incontinent and need frequent washing and changes of clothes.

Class numbers in such circumstances can be very much lower than in mainstream education.

The staff

The adult : pupil ratio has, of necessity, to be very high in special schools. Teachers take charge of classes, the curriculum and learning regimes, but there are adults in many support roles who play a vital part in the running of the school and the pupils' learning (especially the learning of life-skills).

The needs of all staff need to be built into the design of science accommodation, as well as the needs of pupils.

Location and size of science accommodation
As with all learning spaces within the school, good access is needed to the back-up spaces, particularly to the hygiene areas and toilets.

For an ordinary class base, a floor area of 65m^2 is likely to be recommended in the new BB77. Indeed, the space needed for supporting staff, for wheelchairs and other support equipment and to enable flexible teaching and learning methods all point to larger areas. The total science area would need to be larger, even than this, in order to account for the storage and preparation of science chemicals, materials and equipment. Whatever area is being considered, a separate preparation area with lockable storage is a necessity.

The shape of the room is also important. Long, thin rooms, or 'L' shaped rooms are not generally conducive to good teaching and learning.

Zones within the science accommodation
In the best solutions, smaller rooms will be provided within the total science accommodation to store and prepare chemicals, to store and service science equipment, and for an office for the science teacher and support staff.

Many special school pupils find working at science benches difficult for any length of time and benefit, both physically and behaviourally, from ordinary desks and chairs being available. Therefore, if space is available, a second zone might be the 'ordinary classroom' area; something which has been tried in mainstream schools, for similar reasons. Ordinary desks and chairs can be moved around more easily to create zones for drama, role play and discussion, or areas for pupils to crash-out on floor cushions or have a quiet area if needed ('time-out').

Space is essential within the room to store the extra wheelchairs, alternative chairs, floor cushions, etc, that are needed by individual pupils. Chairs for support staff also need a space for storage when they are not in use. If perimeter benching is not installed, this could provide these sorts of storage zones. Alternatively, if adult support is readily available for very small groups, perimeter benching might be used, with a lesser number of bollards / fixed benches.

Easy access to the outside is a good idea, possibly with a small environmental area if this is possible, perhaps some of this under cover. This enables teaching to encompass parts of the biology and environmental curriculum and help pupils to appreciate responsibilities for living things by growing plants. Obviously the type of plants used need careful consideration. Any outside area should have obvious boundaries so that pupils can be supervised as necessary. An outside area may also help with 'cooling-off' periods for pupils with challenging behaviour.

The problem of pupils needing instant access to food or drink is heightened in science. Drinking and eating is usually banned completely in school laboratories, but it may be possible to design in an area in the corridor just outside.

Furniture
Due to the huge variety of demands likely to be made by individual pupils' needs, furniture provision needs to be flexible. It also needs to be of good quality and easy to maintain because wheelchairs and other equipment are likely to batter it.

The science teaching area will need access to services (mains electricity, gas, water, drainage) for pupils' experiments and teacher demonstrations. These will normally be supplied by bollards or fixed benches (e.g. octagons, circles, teardrops) with services within them. Fixed benches with services may be more robust than smaller bollards, or services may be contained in perimeter benching.

Because of the small number of pupils, demonstration areas and pupil benches may be served by the same furniture. A number of benches will be at the normal height, but many pupils will need different heights according to need. Several adjustable height benches may therefore be needed. In terms of safety and maintenance, it may be better for services to be on fixed benches / bollards, with adjustable height benches being placed alongside; although longer gas tubing and extension leads for electricity may be needed.

Lab stools should be available, but also a selection of other chairs. Some pupils will have their own customised seating. Supporting adults will need stools to sit on and there should be enough for a maximum of one adult for each pupil.

In any 'ordinary classroom' zone, tables and chairs should be of the same design as used elsewhere in the school.

Teachers will need the ordinary display and ICT provision; e.g. whiteboards, display boards, and ICT projection equipment.

A wash-up sink, with hot and cold water and draining board, is needed both for science experiments and for pupils' particular needs.

Pupils' equipment
Wheelchairs, hoists, etc, make great demands on floor space and furniture. There needs to be plenty of space to manoeuvre these within the room.

Doors need to be wide enough to accommodate the largest hoist. Door-closers, if used, should not impede passage. View panels are needed that extend almost the whole height of the door so that both pupils and helpers can see what is coming the other way. Such view panels should never be covered with posters; a common problem in both special and mainstream schools.

When pupils come into the science area they may need to transfer from one sort of wheelchair to another, or to stools / chairs within the room. This means that dedicated space may be needed, out of the way, for storage of all those items that are not in use for the lesson.

Sometimes, a pupil's very particular needs cut across ordinary design for science practical work. For example, a pupil permanently on oxygen poses a high risk if

naked flames are used. In such a case, alternative heating methods must be considered and this may mean provision of alternative equipment. CLEAPSS can produce written advice on request. There are also examples known of pupils with these needs in mainstream schools.

CLEAPSS guide L77 ‘Science for Pupils with Special Needs’ gives good advice on adaptations for science equipment for pupils with different physical impairments.

The Science Room Environment

The look, feel and general atmosphere of a special school room has a profound effect on both the behaviour and the learning of pupils, even more so than that in mainstream schools.

Colour and contrast

Quiet colours for walls, floors and furniture can create a calming influence and help keep pupils (and staff) focussed. Use of garish, clashing colours can adversely affect a whole range of pupils’ behaviour; as it can also in mainstream schools. Advice on provision for visually-impaired pupils points to the use of contrast for things like handles, distinguishing between walls, floors and doors, and so on. However, contrast does not have to mean very bright, primary colours. RNIB advice is to ‘choose clear/light colours such as pale yellow for walls, white for ceilings and go for stronger colours to pick out critical surfaces such as doorways and skirting boards’. BB94 makes the point that ‘most pupils with visual impairments can perceive relatively subtle contrasts’.

Control and maintenance

Services for science practical work (gas, electricity, water) must have independent master controls inside the room for the teacher to use. This is so that each, or all, can be isolated if not needed in that lesson so that pupils cannot accidentally, or deliberately, misuse them.

Teacher control of lighting, heating, cooling and ventilation is also important, so that optimum conditions can be maintained for each class, sometimes even for individuals. Some pupils can be very vulnerable to changes in temperature, etc; more so than pupils in mainstream education (although such independent control would be a good idea in mainstream education as well).

All services need to be well maintained so that there is nothing to detract from pupils’ safety, well-being and learning. This is greatly assisted when provision and installation is of high quality in the first place.

Lighting

Good lighting is essential to reading and learning, even more so for pupil with visual impairment. A minimum of 300lux on work surfaces and additional, flexible lighting where needed. Lights should be wired in small groups, in logical sequences with the switches. Additional lights, on the benches, may be required for individuals or for particular practical work.

Glare is a particular problem for the visually impaired and should be avoided. Indirect lighting is preferred, reflections should be avoided by not having highly polished floors or bench tops, and glare from sunlight should be controlled by adjustable blinds at the windows.

Hearing impaired pupils need good lighting conditions in order to be able to lip-read or follow signers.

Lights should not cause distractions in operation. Noisy lights add to background noise and prevent hearing. Energy saving systems, where lights go off after pre-determined times, should be avoided because they startle pupils, distract from the task in hand and may cause distress to some pupils when they go off unexpectedly.

Signs

Way marking within the schools and signs within the Science Room should be clearly distinguished by shape and colour.

Only approved health and safety signs (Health and Safety Signs regulations) should be used.This is particularly important in science with its specific risks and the fact that heath and safety is part of the national curriculum in science. However, all the approved signs have very distinctive colours and the only care needed is to ensure that the background enables these to stand out.

Acoustics

Noise levels, frequencies and reverberation times all impact on the acoustic 'atmosphere' of a room. Pupils may be startled by sudden or loud noises, or not able to hear because background noise covers up the sound they need to hear. Rooms should therefore be 'quiet' in general. Visually impaired pupils may rely heavily on hearing, so good acoustic design is as important to them as it is to the hearing impaired; indeed to all learners.

The reverberation time in particular can severely affect pupils (and adults) ability to distinguish speech accurately. (Reverberation time = the time for a noise to die away.) For mainstream labs this is advised at < 0.8 second (BB93); which allows echoes to aid the projection of speech, but does not cause the multiple echoes that confuse hearing. However, the advice for hearing impaired pupils is a reverberation time of 0.4 second (BB93); which allows clarity of sound, but does not help speech projection. This may not be too much of a problem with very small classes, but teachers need to be aware of it and not strain their voice when teaching.

A science area may well be 'hard' acoustically, with hard benches, hard floors, etc. It will be necessary to install such things as soft-board notice-boards that can absorb sound, as well as being good places for displaying posters and pupil work.

Flooring and seating

The science area needs flooring impervious to liquids; generally vinyl sheeting. Vinyl sheeting is also reasonably good acoustically.

The stools and chairs used should be good quality, with feet that do not grind their way in to the floor (legs that bend round to form skids are a good solution).

Heating, cooling and ventilation
As above, teacher control of these services is important in providing an environment that is appropriate for individual pupil's health, comfort and learning needs. At the same time, these services should be quiet in operation so that they do not contribute to the background noise that can mask teacher's and pupils' speech.

Solar gain can affect the internal temperature of the room greatly so adjustable blinds are important. Blinds are also useful for some science practical work (mainly in the physics parts of the curriculum).

When designing for heating, cooling, and ventilation it is important to make the requirements of teachers and pupils the first priority. For example, fixing a radiator underneath the whiteboard position may be the best site for heating design calculations, but it will mean that the teacher 'roasts' while using the whiteboard. Putting teachers and pupils needs first means finding alternative positions for radiators and re-working the calculations to achieve appropriate room temperatures.

Communication and ICT
All school communications system should be present in the Science Room. Internal telephones are important, both for the room itself and the science staff office. Internet and intranet connections are important (again in room and office) for lesson presentations by the teacher and pupils, research by the pupils and the teacher, and also for efficient school administration.

Science and other specialist spaces
Multi-purpose spaces, such as science + food technology, are not recommended.

Finance!
Lack of finance may lead schools to attempt conversions that do not provide properly for teaching and learning and/or have adverse effects on pupils' health, safety and welfare.

CLEAPSS, for example, argues strongly against the use of gas canisters for Bunsen burners; see CLEAPSS Guide L164, *Portable Laboratory Gas Burners*.

Further advice
DfES – the new Building Bulletin 77, when published.
Laboratory Design for Teaching and Learning website updates – www.ase.org.uk.ldtl

CLEAPSS Helpline – 01895-251496

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