

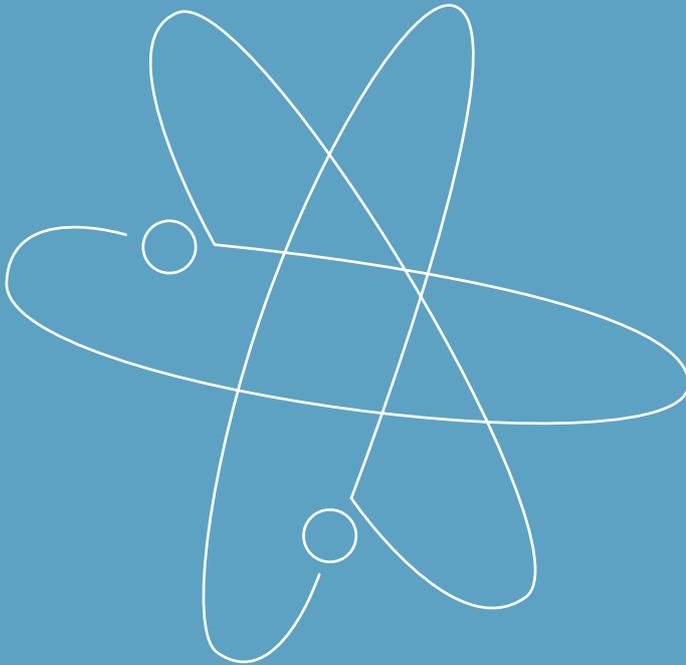
PRIMARY

Social, Environmental and Scientific Education: Science

Guidelines for Teachers of Students with

MILD

General Learning Disabilities



Contents

SESE: General introduction	3
Science: Rationale and introduction	8
Science: Approaches and methodologies	17
Exemplars	23

SESE: General introduction

Social, Environmental and Scientific Education (SESE) is presented through three subject areas in the *Primary School Curriculum*. These are history, geography and science.

Introduction

This is one of three documents designed to enable students with mild general learning disabilities to access SESE as presented in the *Primary School Curriculum*. In presenting these guidelines, recognition is given to the fact that the aims and objectives of the guidelines are the same as those outlined in the *Primary School Curriculum*. Given the breadth of the subject matter, differentiation may be necessary at many levels. The primary school SESE curriculum, however, remains the curriculum statement for this group of students and these guidelines are intended as a supplement to it rather than a replacement for it. These guidelines therefore should be read in conjunction with the primary school SESE curriculum.

The curriculum states that an understanding of the term 'environment' is essential to an appreciation of the nature of SESE and it offers the following:

The word 'environment' is used in this curriculum to denote the surroundings or external conditions with which an individual (human or other living organism) or community interacts. (Primary School Curriculum, 1999.)

Within this definition 'environment' is categorised into two broad groups, natural environments and human environments. While presented as three discrete subjects in the curriculum, history, geography and science are closely related and each seeks to provide for the students an understanding of one aspect of 'environment' both at local and global level.

By studying the constituent subjects of SESE, students are enabled to develop an awareness and appreciation of the natural, human, social, cultural and historical dimensions of life. They are also encouraged to develop an understanding of the physical world, the relationship of humans with their environment, and the historical process through which that relationship has grown.

Curriculum planning

When planning the curriculum in SESE for students with mild general learning disabilities the core principle of maintaining a balance between skills and knowledge while reflecting a spiral approach is preserved in these guidelines. There should be specific teaching of the language of history, geography and science. The following additional points should be considered.

- Students' direct experiences, fieldwork, and trips and work in the environment will be the starting point for all activities.
- Time and chronology are relevant to all three subjects in SESE and often pose a particular challenge to the student with mild general learning disabilities. The practice of recording the passing of time, of establishing classroom routines that draw the students' attention to the measurement of time, and teaching and practising the language of time are important for senior students as well as those in the junior classes. This should be done in an age-appropriate manner.
- Integration of areas within SESE and with other areas of the curriculum is important. Schools will also need to take into account that there is considerable overlap between the skills area of geography and science, and that particular skills can be developed through either curriculum.
- Time should be allocated to practise new skills and to develop competence using new equipment.
- The use of a range of methodologies for each topic will be important.

Organisational planning

In order to ensure successful planning for students with mild general learning disabilities, particular structures need to be put in place at a whole school level, in order to facilitate successful curriculum planning and to ensure agreed practices that enable the student to engage fully with the curriculum. Particular attention should be given to the following:

- Time should be provided for collaboration between class teachers, resource or learning support teachers, the principal, parents/guardians and relevant professionals to establish the strengths, areas of need and priorities of individual students. It will also be important to have agreed procedures for the use of information in psychological reports, for gaining information from previous class teachers, and for record-keeping.
- There should be agreement on the range of assessment tools and methods to be used with these students, and the resources necessary to implement them. For example, oral reports may require the student to use a dictaphone or small tape recorder.
- Working in the environment is central to the delivery of the SESE curriculum. In order to ensure that students with mild general learning disabilities engage with purpose in these activities, regular short trips that focus on the skills required to work outdoors are necessary.
- Routines common to all classes, especially those involving activities in the environment should be developed. These can be introduced to the students at the early stages of learning and developed further as they mature. They would cover issues such as safety, looking after belongings, equipment, responsible behaviour when working out doors, etc.
- Agreement should be reached on the role of school personnel such as special needs assistants or classroom assistants, given that SESE content incorporates such a high level of activity.
- Areas and sites in the environment that are appropriate areas of study at each class level and for each subject area should be identified.

- A stock of resources should be acquired, including items such as pictures, videos, computer software, artefacts, materials, tools and equipment necessary to carry out investigations in science and geography, junk material and construction toys for designing and making local maps and plans.
- A policy should be agreed on the role and use of textbooks, The SESE curriculum provides for a balance between knowledge and skills acquisition, and an essential element of SESE is that student learning is active and concrete. This feature makes the curriculum particularly accessible to students with mild general learning disabilities. Given that the vast majority of these students will experience difficulties with literacy skills, a textbook approach to SESE will only serve to exclude them.
- Environmental awareness and care should be an aspect of all activities relating to the human or natural environments.
- Identify as many ways of recording findings and presenting ideas as possible, for example oral reports, photographs, drawings, models, video, student demonstrations, role play, diagrams, charts using writing or symbols, and information technology.
- model appropriate language usage and skills, such as thinking aloud, questioning, speculating, making observations, making predictions based on simple observations, drawing attention to and commenting on similarities and differences
- demonstrate skills and activities by verbalising their actions in clear simple language
- demonstrate using the senses to make observations in an incidental manner during the school day
- make deliberate errors and self-correct out loud, showing that trial and error is an essential aspect of learning in SESE.

Classroom planning must address the issues outlined in the curriculum planning at school level, as well as planning for differentiation in the classroom to suit the particular needs of individual students with mild general learning disabilities. In order to do this the teacher will need to

Classroom planning

Planning for SESE at classroom level for students with mild general learning disabilities poses particular challenges for the teacher. The sheer scope of the three subject areas means that careful selection of content and opportunities to develop skills will be required. Classroom planning can be divided into two areas, classroom management and planning units of work. Teacher behaviour is also a significant factor in the successful delivery of the curriculum to this group of students at classroom level. The following teacher behaviour can assist the student with mild general learning disabilities to follow instructions more successfully. Teachers should

- be aware of their own language use, adjust their rate of speech, use simple vocabulary, and demonstrate word meanings
- give instructions one at a time, pointing and directing and using visual cues
- take into consideration the individual language profile of each student
- use all available information to identify the particular strengths and areas of difficulty of each student
- use this information when designing tasks, to make decisions about differentiating activities in terms of skills, content and outcomes
- plan for the fact that students with mild general learning disabilities will need additional opportunities to practise new skills and to develop competence in using new equipment, and that they will need to over-learn new content and language
- plan suitable methods for individual students to present their work.

The most important aspect of the curriculum in SESE is the interdependence of its subject areas, and its links with other areas of the curriculum. The *Primary School Curriculum* recommends an integrated theme approach to the three areas of SESE, particularly in the junior classes. It is important that an integrated theme approach is the primary method used with students at the senior end of the school also. This approach has a number of features that make it attractive for students with mild general learning disabilities:

- it is more efficient in terms of teaching and learning time
- it allows for the transfer of knowledge and skills from one area to another
- it allows the teacher to plan themes that begin with a context very familiar to the student, and then to extend that theme outwards into unfamiliar contexts
- in planning for learning through themes, the teacher can more easily strike a balance between the presentation of the historic, the geographic, and the scientific aspects of content.

Assessment

The purpose of assessment for students with mild general learning disabilities, as for all students, is to provide information on student progress and to plan for further learning. The tools used by teachers will be the same as those used for the general population of students but may need to be adjusted in order to facilitate individual student needs.

Classroom management

Classroom management issues are those organisational issues that maximise participation and learning in the classroom. Structures should be put in place that encourages the student to work as independently as possible at all stages of the learning process. Those that may be relevant to the SESE subjects are as follows:

- Match the needs of the student to the activity and employ a variety of seating arrangements to suit these. At times students may work best in pairs, in groups or individually. Students with attention difficulties may benefit from having access to a quiet work area where individual work can be carried out and timed. This area should be partially enclosed and completely free from all visual distractions such as pictures, displays or windows.
- Students can be taught to use checklists to guide them through regular work routines in the classroom. They can begin using simple steps outlined on a chart with pictures, symbols or words. Over time the students can come to verbalise these and to monitor their progress as they work. Predictable routines are particularly important for working in the environment as they provide a structure for the student.
- Students need to have access within the classroom to resources that enable them to participate in hands-on activities relating to history, geography and science. Some of these are outlined in detail in the subject areas.
- Safety is an important issue for all students. Advice on student safety while working in the environment and carrying out investigations in geography and science is offered in the *Primary School Curriculum*. For students with mild general learning disabilities it is important that safety rules are explicitly taught and practised regularly. Symbols representing hazards and the safe use of equipment and tools should also receive regular attention. Much of this work can be practised and extended through SPHE.

- Planning for appropriate and varied methods of communication of ideas and understanding is an essential part of planning work units for students with mild general learning disabilities. This may require easy access to suitable equipment such as a tape-recorder, a camera, a video camera, a computer, and construction or art materials, as well as appropriate writing materials.
- The methodologies suggested for SESE are entirely activity based. In order to implement these, careful consideration needs to be given to the best use of extra personnel such as special needs assistants and classroom assistants.
- Initiating investigations arising from students' own questions is a key aspect of the SESE programme. Students with mild general learning disabilities may be less likely to pose questions relating to phenomena spontaneously, but the teacher can promote this by deliberately arranging situations, which lead to observations and questions. For example, placing tools or vessels made of paper in the sand or water play areas could lead to questions as to why they don't work, and to an investigation of the most appropriate materials for use with water etc.

Science: Rationale and introduction

In the *Primary School Curriculum* science is presented as one aspect of Social, Environmental and Scientific Education, and is intended to complement the development of the students' geographical and historical skills.

Rationale

The *Primary School Curriculum* describes science as a combination of knowledge and understanding of the biological and physical aspects of the world, and the processes through which this knowledge and understanding are gleaned.

Science is also concerned with the development of concepts and attitudes. Traits such as independence, perseverance, curiosity, and patience are fostered through scientific activities.

The inclusion of science in a curriculum for students with mild general learning disabilities is important for a number of reasons. Through scientific activities students can be encouraged to observe, to test, to confirm, or to change their ideas about how things are and how they work. The knowledge base of science has a practical application to everyday experiences and is therefore important for social development. By working scientifically, through simple investigations involving planning, testing, recording and analysing results, students come to appreciate the nature of the learning process. This experience is particularly important for students with mild general learning disabilities as they are often impeded by their lack of awareness of the learning process. The constructivist view of learning embedded in the science curriculum highlights the importance of interactive learning. In this approach, difficulties with literacy do not present a barrier to full participation at any level. Designing and making activities provide opportunities for students to display and to develop their creative and imaginative capacities. These activities also enable them to experience an ongoing sense of success in their learning. This is vital for the self-esteem and confidence of the student with mild general learning disabilities.

Introduction

The content of the primary school science curriculum is outlined in four strands. While the strands and strand units are almost identical at each class level, the content and processes are developed and extended as the student progresses through the school. This spiral approach facilitates the extension and development of concepts, skills knowledge, and attitudes at each level. It also facilitates the planning of access to the curriculum for students with mild general learning disabilities at a number of different levels within the same class group. The strands and strand units are reproduced on the following page.

The content of the science curriculum has a number of features that are valuable and attractive for students with mild general learning disabilities. The strand *Living things* is concerned with developing the students' knowledge of humans, plants and animals, their life processes and inter-relationships. An awareness and understanding of the environment is essential to enable students with mild general learning disabilities to benefit from the SESE curriculum.

Energy and forces describes the different forms of energy: light, heat, sound, electricity and magnetism, – which are encountered through investigations and activities. *Materials* involves the exploration of different everyday materials, their characteristics, and the processes by which they are changed. Both of these strands offer the student with mild general learning disabilities the opportunity to develop critical thinking skills and to clarify their ideas about how things work. *Environmental awareness and care* is a strand common to the science and geography curricula and is essential for the development of responsible attitudes to the environment and a sense of citizenship.

A most important feature of the science curriculum for students with mild general learning disabilities is that it is entirely activity based. Students do not need to have achieved any particular level in literacy or numeracy to participate in and benefit from this curriculum.

The strands and strand units of the science curriculum

Strand	Infant classes	First and second classes	Third and fourth classes	Fifth and sixth classes
	Strand unit	Strand unit	Strand unit	Strand unit
Living things	<ul style="list-style-type: none"> ■ Myself ■ Plants and animals 	<ul style="list-style-type: none"> ■ Myself ■ Plants and animals 	<ul style="list-style-type: none"> ■ Human life ■ Plants and animals 	<ul style="list-style-type: none"> ■ Human life ■ Plants and animals
Energy and forces	<ul style="list-style-type: none"> ■ Light ■ Sound ■ Heat ■ Magnetism and electricity ■ Forces 	<ul style="list-style-type: none"> ■ Light ■ Sound ■ Heat ■ Magnetism and electricity ■ Forces 	<ul style="list-style-type: none"> ■ Light ■ Sound ■ Heat ■ Magnetism and electricity ■ Forces 	<ul style="list-style-type: none"> ■ Light ■ Sound ■ Heat ■ Magnetism and electricity ■ Forces
Materials	<ul style="list-style-type: none"> ■ Properties and characteristics of materials ■ Materials and change 	<ul style="list-style-type: none"> ■ Properties and characteristics of materials ■ Materials and change 	<ul style="list-style-type: none"> ■ Properties and characteristics of materials ■ Materials and change 	<ul style="list-style-type: none"> ■ Properties and characteristics of materials ■ Materials and change
Environmental awareness and care	<ul style="list-style-type: none"> ■ Caring for myself and my locality 	<ul style="list-style-type: none"> ■ Caring for myself and my locality 	<ul style="list-style-type: none"> ■ Environmental awareness ■ Science and the environment ■ Caring for the environment 	<ul style="list-style-type: none"> ■ Environmental awareness ■ Science and the environment ■ Caring for the environment

Skills in science

Skills to be developed through the science curriculum are outlined under two headings:

- *Working scientifically*
- *Designing and making.*

When planning science activities for students with mild general learning disabilities a number of issues need to be considered. While students may display particular strengths in one skill area, other areas may be quite underdeveloped. With careful planning, this should not prevent these students from engaging with the curriculum with real purpose. The issue of oral language development poses two challenges for the student and teacher in relation to science. One is that skills development can be impeded because of a delay in oral language development; learning *through* language may not have occurred to the degree that it might for students of the same age. In order to assist these students to benefit fully from scientific activities teachers need to refer to the guidelines relating to oral language development. The science curriculum can be used as a vehicle to develop the oral communication and critical thinking skills outlined in that section. A second challenge for the teacher is to see beyond communication difficulties and allow students to display and develop skills in science to their full potential. Some students will have considerable aptitudes and skills (particularly in designing and making), which they cannot communicate orally. The teacher should facilitate these students by allowing them to demonstrate, to draw, to make models, or to use gestures or symbols to communicate their ideas. The teacher can then talk through demonstrations for the student.

Working scientifically

Practical engagement with the biological and physical aspects of the world is particularly important for students with mild general learning disabilities. Through these 'hands-on' experiences, they can develop more easily a clear understanding of how things work and why things act as they do. Without these experiences, students with mild general learning disabilities can encounter great difficulty in acquiring new knowledge and in forming new concepts. Dealing with concepts and knowledge in an abstract manner

can equally be extremely challenging in the absence of practical everyday experiences.

Practical activity is therefore central to the science curriculum for students with mild general learning disabilities. Working scientifically describes the process of scientific enquiry through which the students interact with their environment and its components in gaining new knowledge and understanding. It outlines the skills that underpin the process of learning scientifically. The students develop these skills through their scientific investigations and activities. They comprise

- *questioning*
- *observing*
- *predicting*
- *investigating and experimenting*
- *estimating and measuring*
- *analysing*
- *recording and communicating.*

There is significant overlap between skills in the curriculum for science and geography. Appendix 1 describes progression in the development of these skills, from junior infants to sixth class, as outlined in the *Primary School Curriculum*, and may be useful in assessing the level of skills development of the student with mild general learning disabilities placing him/her at an appropriate level.

Designing and making

Designing and making constitutes the technological component of the science curriculum. Activities of this nature encourage students to use their existing knowledge and levels of skills development in the design and construction of models and artefacts in response to a practical problem. The skills involved in the designing and making process are

- *exploring*
- *planning*
- *making*
- *evaluating.*

The development of these skills is particularly important for students with mild general learning disabilities. Exploring possibilities for design by examining shape, materials, aspects of measurement, and efficiency offers rich possibilities in the development of language skills, as well as of mathematical and scientific concepts. The process of designing and making is also very important because it allows the student with mild general learning disabilities to engage in planning, testing and reviewing work. These aspects of the learning process are extremely important for this group of students for a number of reasons. Through successful planning students begin to understand that there are steps to be followed in the learning process. As they are guided through them, they begin to recognise the steps and are less likely to become frustrated and to give up on a task, each step having been identified at the planning stage. Understanding that trial and error are necessary aspects of learning will encourage these students to take risks and to accept that a given problem may have a number of solutions rather than a right and wrong answer. Designing and making also enhances creative and aesthetic development. In this manner, practical, problem-solving aspects of design in the science curriculum integrate with the construction strand of the visual arts curriculum. This sense of holistic learning is especially important and beneficial for students with mild general learning disabilities.

The science curriculum outlines the progression in skills development in designing and making across all four class levels.

- Infant classes—pages 22 and 23.
- First and second classes—pages 39 and 40.
- Third and fourth classes—pages 59 and 60.
- Fifth and sixth classes—pages 81 and 82.

When planning opportunities for designing and making, these pages can be used by the teacher to decide what level the student should be working at in relation to each skill.

Addressing potential areas of difficulty for students with mild general learning disabilities

▲ Potential area of difficulty	= Implications for learning
Delayed language development/poor vocabulary	<p><i>Students may have difficulty</i></p> <ul style="list-style-type: none"> • following a sequence of ideas/instructions • expressing their own ideas • understanding/retrieving appropriate terms • predicting, analysing, etc.
+ Possible strategies	
<ul style="list-style-type: none"> ■ Teach the language of science demonstrating meaning and/or using visual aids. ■ Have the student demonstrate scientific phenomena, for example floating/sinking—using ‘<i>give me, show me, make me,</i>’ as much as possible. ■ Assist the student in expressing ideas through scaffolding, verbalising a demonstration. ■ Model posing questions. 	

▲ Potential area of difficulty	= Implications for learning
Fear of failure/poor self-esteem/fear of taking risks	<p><i>Students may lack confidence in</i></p> <ul style="list-style-type: none"> • their own ideas about phenomena or will look for one right answer • presenting their own ideas in designing and making.
+ Possible strategies	
<ul style="list-style-type: none"> ■ Model the speculation of a range of answers/ideas. ■ Repeat and record suggestions from the students and refer back to them. 	

▲ Potential area of difficulty	= Implications for learning
Fine/gross motor control	<p><i>Students may find</i></p> <ul style="list-style-type: none"> • activities difficult and become easily frustrated • designing and making difficult, for example manipulating craft equipment.
+ Possible strategies	
<ul style="list-style-type: none"> ■ Choose resources/equipment appropriate to the student, bearing in mind safety issues as well as the student's dexterity. ■ Allow the student very regular short practice sessions with new equipment. ■ Break activity into steps and plan intervention with the student at particular stages. ■ Identify the stages for the student, acknowledging progression from one stage to the next. 	

▲ Potential area of difficulty	= Implications for learning
Body image and awareness	<p><i>Students may</i></p> <ul style="list-style-type: none"> • experience impeded development of gross or fine motor control • experience impeded development of spatial awareness • develop inaccurate images of the location of body parts • develop inaccurate understanding of functions of body parts • label body parts incorrectly • experience delay or fail to develop the ability to draw pictures of people.
+ Possible strategies	
<ul style="list-style-type: none"> ■ See Exemplar 1 in these guidelines. ■ Use PE to develop body awareness. 	

▲ Potential area of difficulty	= Implications for learning
Personal organisational and planning skills	<p><i>Students may</i></p> <ul style="list-style-type: none"> • become distracted by inconsequential aspects of the task or its organisation • begin out of sequence • become frustrated and give up • lose confidence.
+ Possible strategies	
<ul style="list-style-type: none"> ■ Clarify the purpose of the activity for the student. ■ Demonstrate collection and organisation of resources, planning out loud. ■ Break the task into small manageable steps, modelling and verbalising for the student: <i>'First I'm going to ... next ...'</i>. ■ Provide checklists (pictorial or written) for regular routines, teaching the student how to use them. 	

▲ Potential area of difficulty	= Implications for learning
Short-term memory	<p><i>Students</i></p> <ul style="list-style-type: none"> • may not be able to bring findings from one stage to the next in an investigation.
+ Possible strategies	
<ul style="list-style-type: none"> ■ Provide the student with visual clues/symbols which can be used to remind him/her of various stages of the investigation. 	

▲ Potential area of difficulty	= Implications for learning
Classification	<p><i>Students may</i></p> <ul style="list-style-type: none"> • not be able to see fine differences or similarities easily • become confused when more than one similarity/difference is involved.
+ Possible strategies	
<ul style="list-style-type: none"> ■ Work slowly from one stage to the next. ■ Use concrete examples, for example students in the class with brown hair/students with brown eyes/ students with both. ■ Choose similarities/differences that are easily observable. 	

▲ Potential area of difficulty	= Implications for learning
Time	<p><i>Students may have</i></p> <ul style="list-style-type: none"> • difficulty with the measurement of time and the concept of time passing.
+ Possible strategies	
<ul style="list-style-type: none"> ■ Science provides endless opportunities to focus the students' attention on the passing of time. Measurement of time should be built into investigations where possible. ■ Observations of changes occurring over a day, a week, a month, and the seasons should be planned. ■ Plan to record time passing in a way that provides a visual image for the student, for example, colouring days on a calendar or parts of a clock face. 	

Science: Approaches and methodologies

The *Primary School Curriculum* suggests a variety of approaches and methodologies in the mediation of science.

These approaches are presented under two broad headings: an investigative approach and a teacher-directed approach. Both approaches play an important role in presenting learning experiences that take cognisance of the specific needs of students with mild general learning disabilities.

An investigative approach and a teacher-directed approach

A number of key considerations must be kept in mind whether using the investigative approach or the teacher-directed approach. These include:

- **Starting with the students' own ideas and experiences.** The constructivist view of learning upon which the science curriculum is based, emphasises building on students' current levels of experience and understanding. Through engaging in practical activities, students with mild general learning disabilities encounter new ideas and ways of thinking. These in turn challenge and alter their existing knowledge and understanding. Accessing these students' existing ideas can, however, be difficult. Students can lack the confidence to express their ideas for fear of failure or rejection. Likewise, they can experience difficulty in verbalising their own ideas, particularly in the case of students with delayed language development or poor vocabulary. Teachers need to employ certain strategies to elicit students' ideas on a given topic or issue. A comfortable, supportive learning environment will better encourage students with mild general learning disabilities to express these ideas. By acting as a learning partner, the teacher can, through questioning, suggesting, explaining, inferring, etc., better facilitate the students in communicating their ideas. It may also be important to utilise alternative modes of communication. For example, students with mild general learning disabilities may prefer to express their ideas through drawings, constructions, modelling, or writing. These different communicative modes should be accommodated.
- **Encouraging and facilitating practical activity.** As outlined in the sections *Working scientifically* and *Designing and making*, opportunities to engage physically with objects and the environment are pivotal to supporting learning in science for students with mild general learning disabilities.

- **Providing opportunities to work in the environment.** These opportunities are particularly important for students with mild general learning disabilities. They help them to develop a stronger sense of identity and connection with their locality and community. They also bring enjoyable, exciting, and discovery-based dimensions to learning which are important for the continued motivation of these students.
- **Applying new information and ideas to everyday experiences.** Science, like all other areas of learning, must have a strong sense of relevance for students with mild general learning disabilities. As many of these students have below-average intellectual functioning and delayed cognitive and conceptual development, this relevance is central in sustaining their interest and in demonstrating to them the value of learning.
- **Providing opportunities for students to work together in sharing ideas, discoveries and findings.** The sense of security and support provided by collaborative learning can be very important to students with mild general learning disabilities. However, careful consideration is needed in the allocation of working partners, as these students can easily feel intimidated by a more competent learner.

Investigative approach

Using an investigative approach, students seek to solve problems and to raise questions through a combination of closed activities and open-ended investigations.

Closed activities

Closed activities are activities that involve the teacher in presenting students with data and materials, and in guiding them towards the discovery of a pre-determined idea or concept. This approach has a number of benefits for the student with mild general learning disabilities. It is highly structured, planned from start to finish, and can be broken into controlled steps through which the student can observe and measure progress.

It also allows the teacher to strike a balance between the learning process and the content. Closed activities can enable these students to gain confidence in the practice of scientific skills and to experience success. The *Primary School Curriculum* suggests that such activities can be successfully carried out through the use of commercial workcards or teacher-designed sheets. However, the use of written instructions should be avoided in the case of students with mild general learning disabilities. Commercially produced worksheets may expose students to unfamiliar language making the task/activity more difficult. The most effective method of introducing closed activities to this group of students is through teacher demonstration, explanation and discussion.

Open investigations

Open investigations are investigations that arise from the students' own questions. The teacher, acting as a facilitator, provides the opportunities for the exploration of these questions. This methodology, while lying at the heart of the problem-solving model of science education, poses particular challenges for students with mild general learning disabilities. Many of these difficulties are outlined in the guidelines on communication and language. Reluctance to take risks, to offer elaboration, to accept that a problem may have more than one solution, to anticipate or predict what might happen next, and to interpret what information is relevant to the problem, all make this methodology challenging for them. The *Primary School Curriculum* sees language as central to the learning process in that students not only learn language but learn through language. It is important, therefore, that this methodology is used with students with mild general learning disabilities.

If students with mild general learning disabilities are to benefit from open investigations in science, the investigations should be kept simple. If the area of knowledge or the process relating to the investigation becomes too complex, then the student will lose focus and the purpose of the investigation will become lost. As open investigations are driven by the students' own ideas, the teacher will need to support them in the articulation of those ideas.

The teacher will also need to play a considerable role in facilitating the learning process by modelling appropriate skills and behaviours, by making constructive and helpful suggestions, and by verbalising the process for the students. Skills and behaviour associated with scaffolding open investigations include

- questioning out loud
- speculating
- demonstrating trial and error
- providing a range of possible answers to questions.

These can be done in an incidental manner throughout the school day, during almost any subject.

Exemplar 10 in *Primary School Curriculum: Science, Teacher Guidelines*, outlines the stages of an open investigation. These guidelines should be consulted by the teacher when planning open investigations for students with mild general learning disabilities.

Teacher-directed approach

The teacher-directed approach involves the teacher telling or showing the student what to do. Content and objectives are decided in advance by the teacher. The *Primary School Curriculum* suggests this approach for certain aspects of the science curriculum that do not lend themselves to investigative work, or for demonstrating skills and the use of tools and materials. For students with mild general learning disabilities, it is likely that direct teaching will be used more than is necessary with the general body of students, and that it will feature in some way in most activities. Such an approach provides the students with mild general learning disabilities with the sense of encouragement, guidance, and scaffolding they need to enjoy and to benefit from learning opportunities in science.

Skills development

In addition to the above methodologies, when planning a science curriculum for students with mild general learning disabilities it is essential to plan lessons and activities that allow students to practise skills and aspects of the 'process' relating to science to a far greater degree than would be the case with mainstream students. While all students need opportunities to learn to handle instruments and tools and to carry out certain procedures, students with mild general learning disabilities need to over-learn in the skills area to avoid becoming frustrated when involved in investigative or designing and making tasks. Short, and very regular practice sessions on new skills will help them to develop their skills to a more sophisticated level. This in turn will enable the student to focus more on gaining knowledge when involved in activities.

Any one of the above methodologies, or indeed a combination of them, may be used in teaching any of the strands of the science curriculum to students with mild general learning disabilities. *Primary School Curriculum: Science, Teacher Guidelines* contains exemplars that illustrate how the content might be delivered using these methodologies. The following section offers some advice to the teacher on how these exemplars might be differentiated to accommodate the needs of students with mild general learning disabilities.

Framework for differentiating science activities for students with mild general learning disabilities

Level: Infants to sixth classes

Language

Teach the language associated with the process or problem. Demonstrate meaning where possible, for example, sink and float. Assist understanding by adding extra words (sink down under the water, float on top). Ask the student to demonstrate understanding where possible—*show me, give me, make me, touch*—using this language as much as possible. Ensure that the student can differentiate between the objects and materials being used.

Identify key concepts

Identify key concepts depending on the student's level of maturity and previous knowledge, adding on additional features and concepts.

Establish

Establish the student's current understanding of the concept.

Examine

Examine the number of variables in the experiment. Is it possible to examine these one at a time or to reduce the experiment to just one variable? Giving the student the opportunity to repeat the processes a number of times allows him/her to experience success and enjoy working independently.

Materials

How familiar is the student with the materials/tools/equipment to be used? Does he/she need to learn how to use them first? Are the materials age-appropriate?

Provide

Provide some mechanism for recording the student's ideas or predictions about the outcome or problem.

Time

Does the issue of time need to be addressed. For example, does the investigation require observation over a period of time. If so how will the student record this? Will the student have the same time allocation as other students, or will she/he need more time? If this is the case make it clear to the student that extra time will be made available again.

Break

Break the experiment into small manageable steps, and help the student to identify the steps. Verbalise the process for the student. It may be necessary to record through labelling, photographs, drawings or symbols, stages of the process as well as the outcome.

Demonstrate

Demonstrate steps or aspects of the process that the student might have difficulty with.

Agree

Agree a method of recording the process with the student. When working with students with mild general learning disabilities written records should be avoided. Drawings, graphs, photographs, video, or agreed symbols should be preferred.

Devise

Devise as many activities as possible to investigate the same problem.

Review

Review the work with the student. Allow the student to sequence the stages of the investigation as well as the outcome. Using questioning, the teacher should talk through the work with the student, assisting him/her to comment on the outcome.

Transfer

Transfer the knowledge back to a real situation as soon as the student has reached a conclusion about the test. For example, in relation to heat, the teacher could ask the student what material the radiators are made from. Why wasn't wood/plastic/rubber used?

Strands: *Living things and Environmental awareness and care*

Approaches to learning about living things and environmental awareness and care are presented under a number of headings in the primary science teacher guidelines: *Learning about plants and animals*, *Learning about humans*, and *Environmental awareness and care*.

Approaches to: *Learning about plants and animals, and Environmental awareness and care*

Learning about plants and animals represents much of what teachers would have previously taught as *Environmental studies*. One of the major changes in emphasis in learning about plants and animals in the science curriculum is that these are not studied in isolation but in the context of their natural habitat. The students learn about these plants and animals while learning about the environments in which they live and grow. This approach to learning facilitates the development of an understanding of the inter-relationships and the interdependencies between the plants, the animals and their environment. It also leads to an appreciation and understanding of the role of the environment not only in the lives of plants and animals but in the lives of humans too. Learning about the environment and learning in the environment heighten students' awareness of the impact of human activity on the environment and in this manner, play an important role in cultivating attitudes of responsibility as custodians of the Earth. This learning is most effective when the students are engaged in learning about their environment by being in their environment. As outlined previously, this active, environment-based approach to learning is especially important for students with mild general learning disabilities.

The strands *Living things and Environmental awareness and care* are thus naturally interwoven. When students are engaged in learning about plants and animals they will equally be learning about the environment, its colours, its textures, its living and non-living elements, and how they, the students, can care for and improve it. Exemplars 11-21 in the teacher guidelines offer excellent advice to teachers on the presentation of these aspects of science to students, all of which is valid and applicable to students with mild general learning disabilities. Exemplars 11-16 outline explorations and investigations that can be carried out in the environment. These should be read in conjunction with the *Learning about the local environment* section in the geography component of these guidelines. The advice in this section applies equally to outdoor activities in history, geography, or science.

Approaches to learning about humans

Learning about humans is the second aspect of the strand *Living things*. It is concerned with the examination of the person as an organism belonging to a group that has many common characteristics, as well as variations such as skin, hair and eye colour, height, and weight. It is also concerned with the development of an understanding of the human life cycle, growth, and life processes. This attention to body parts and internal organs is essential for students with mild general learning disabilities. It has already been noted that the development of body awareness may be impeded in these students. This can lead to inaccurate knowledge about parts of the body. It can also create difficulties with gross motor control, which may affect movement and poor perception of the body, and ultimately affect the student's self-esteem. Accurate and detailed information about the body and how it works as well as activities which promote awareness of similarities and differences should, therefore, be part of the curriculum for these students at all levels.

When planning this aspect of science, teachers should be aware that these students may not have experienced the same level of incidental learning relating to this area as their peers, and that some of their information will not be accurate. Assessment of the accuracy of students' prior knowledge and a need to over-learn the language associated with the body should be part of all lessons. When choosing materials, teachers should be careful not to use partial diagrams of organ systems with students. These should always be placed in an outline of the whole body. Work in this area should be integrated with physical education, the visual arts, and SPHE.

Exemplar 35 in the teacher guidelines introduces the identification of body parts and the concept of variation at infant level. The following exemplar suggests additional activities that will complement the teacher's work in this area and assist the student with mild general learning disabilities. While this exemplar is aimed at students in infants to second class it may be possible to adapt some of these activities for older students.

Exemplar 1: Science

Strand: Living things

Strand unit: Myself

Topic: Parts of the body—similarities and differences

Level: Infants–second class (Additional to Exemplar 35 in the Primary School Curriculum, SESE: Science.)

The student should be enabled to

- develop accurate images of the location and function of the parts of the body
- name the parts of the body
- become aware of similarities and differences.

Resources

- Students themselves, dolls with movable joints, puppets, plasticine, pictures, drawing materials.

Assess the level of prior knowledge among the students

- Ask students to name parts of the body indicated by the teacher.
- Ask students to demonstrate understanding of language by touching named parts of the body.
Note any confusion in labelling which needs to be addressed in lessons, for example hand and arm.

Exemplar 1: Science

Activities

- Allow students to trace the outline of the body starting with both hands on top of the head. The teacher demonstrates and verbalises: *'down round the head, over the ears, in at the neck, out at the shoulders, etc.'* Repeat with eyes closed.
- Point to body parts on command and name these parts.
- Use games such as *'Simon Says'* or *'Hokey-Pokey'*.
- Make life-size drawings. Students lie on a large sheet of paper and the teacher traces an outline around them.
- The teacher demonstrates and verbalises drawing and making figures: *'First I'll make the head, then the neck ...'*
- When assessing students' drawings or models allow for delay in fine motor control, and allow the student to describe his/her own model or drawing.
- Teach older students to draw matchstick/sausage people, drawing attention to joints and movable parts.
- Use pictures with missing body parts. Students tell or draw what is missing.
- Encourage the students to make representations of people with Plasticine and clay.
- Use rhymes and action songs relating to body parts.
- Encourage the students to mime actions characteristic of people at work, for example a Garda directing traffic, a carpenter using saw and hammer, a footballer kicking a ball, etc. The teacher verbalises the actions.
- When introducing internal organs use models/body aprons/pictures of whole body to indicate the position of the organs in the body.
- Teach descriptive language associated with body, for example blond, fair, eye colours.
- The teacher models describing people, for example introducing students: *'This is Ann, she has brown hair, etc.'*
- Use dolls, books, pictures, and photographs to practise describing characteristics.
- Assist students to observe what makes them different: eye colour, hair colour, taller, shoe size. Draw attention to similarities.
- Play guessing games. The teacher gives clues. Students try to name the student.
- Sort and group students according to hair colour/eye colour.

Exemplar 1: Science

Strands: Energy and forces, Materials

Approaches to learning about energy and forces, and materials are presented under a number of headings in *Primary School Curriculum: Science, Teacher Guidelines*. They include

- *learning about light*
- *learning about sound*
- *learning about electricity and magnetism*
- *learning about forces*
- *learning about materials*
- *learning about heat.*

Approaches

In *Primary School Curriculum: Science, Teacher Guidelines*, Exemplars 22-34 and 39-43 outline approaches, activities and investigations relating to aspects of *Energy and forces* and *Materials* respectively. These exemplars present investigations that can be carried out through closed activities or open investigations, and outline clearly for the teacher the steps to be taken, from the identification of the problem and working scientifically through the problem, to recording and reviewing the outcome of the investigation. In order to make these activities accessible to students with mild general learning disabilities, the following exemplar sets out a framework through which teachers might differentiate investigations. The framework is then applied to Exemplar 23 from the teacher guidelines that investigates sound, and suggests how this investigation might be differentiated for the student with mild general learning disabilities.

Exemplar 2: Science

Strand: Energy and forces

Strand unit: Sound

Level: Third and fourth class
(Based on Exemplar 23 in the Primary School Curriculum, SESE: Science.)

Initial problem

Can you make a banjo from rubber bands?

Background

The tightness, thickness and length of the rubber band will affect the pitch. Long, thick rubber bands produce low sounds. Thin short rubber bands produce higher sounds.

Assessment

Among the methods that may be used are

- teacher observation of a willingness to try different ideas and willingness to work with others
- a portfolio incorporating the student's drawings, annotated by the teacher under the direction of the student
- an oral account by student of the investigation, with an opportunity to demonstrate.

Resources

Rubber bands of varying thickness.
Labels/stickers to identify those that make high/low sounds.
A box lid.

Before you start

Assess understanding of concepts required.

- Demonstrate high and low pitch to the student.
- Have the student demonstrate high and low notes/sounds.

Assess/teach language usage.

- Teach the words high sound/pitch/low sound pitch. Ask the student to describe sounds using these words.
- Have the student demonstrate that he/she can discriminate between thick/thin and is able to sequence from thickest to thinnest.

Agree a recording procedure that facilitates difficulties with memory.

- Agree a method of recording high/low with the student, for example stickers or labels the student can attach to the bands.

Reduce the number of variables.

Exemplar 2: Science

- Examine the number of variables. There are two in this experiment so it may be necessary to break the activity into two parts/sessions.

Experimenting

- Have the student arrange the elastic bands from thickest to thinnest (longest/shortest).
- Allow the student to experiment by stretching the bands around a range of broad and narrow objects and to pluck them.
- Encourage the student to stretch the bands around the box lid.
- Allow the student to experiment with the elastic bands to ensure that he/she is aware of the best way to get sound from the band.

Development of lesson

Fair test

Spend time helping the student to identify the things that are the same in the test, for example the tension of the band. A concept of fair testing is difficult for students with mild general learning disabilities, and will only be built up over time.

Hypothesising

Does the thickness of the rubber band make a difference to the sound?

Predicting

Students predict which bands will make the low and high sounds. It is important to record predictions.

Test

Test and record the actual sounds.

Compare

Compare the outcomes against the students' predictions.

Review

Review the process with the student, assisting with sequencing and language.

Transfer to real situation

Examine the strings on a real instrument, such as a guitar or a banjo. Identify the thick and thin strings and listen to the sounds.

Follow up

Allow the student to go through the investigation again using the second variable: length (tension).

Allow the student to combine the variables in an investigation.

Allow the student to make his/her own musical instrument.

Exemplar 3: Science

Strand: Energy and forces

Strand unit: Magnetism and electricity

Level: Third to sixth classes
(Based on Exemplar 26 in the Primary School Curriculum, SESE: Science.)

This exemplar presents activities in the strand *Energy and forces*. In particular, it focuses on the strand unit *Magnetism and electricity*. Developing an understanding of electricity and its properties can be very challenging for students with mild general learning disabilities because of the abstract nature of this information. Ample opportunities to engage in practical activities and investigations can greatly enhance their understanding in this area. Some of the activities and approaches, which can be used in delivering a unit of work on electricity to students with mild general learning disabilities, are outlined here.

Initial problem

Can you make a bulb light using one wire?

Assessment

The students may be assessed using the following techniques:

- teacher observation, of a willingness to explore possibilities, willingness to take risks, and to use own initiative
- willingness to work co-operatively in sharing ideas and findings
- a portfolio of the students' drawings of their bulbs when they were lit, annotated by the students themselves or by the teacher, depending on the students' abilities
- students' oral accounts, if necessary the accounts to be assisted and/or guided by the teacher through questioning, suggesting, hinting, inferring, etc.

Resources

Batteries (1.5 to 3 volts).
Insulated wires with bare ends.
Bulbs (compatible with the battery voltage).
Battery holders.

Starting points

Exploring

Allow the students time to play with the resources. This builds their confidence in manipulating them, and suggests ideas to them about how they will light the bulb. This work can be completed in pairs to provide a sense of security and comfort in the initial exploratory phase of the lesson.

Predicting with the teacher as facilitator

The teacher encourages the students to predict how they might light the bulb before actually engaging in the task. In this instance, the teacher may need to use direct questioning, offer suggestions, provide choices, etc. as some students with mild general learning disabilities can find predicting challenging.

Exemplar 3: Science

Development of the lesson

How can you light the bulb with one wire?

Experimenting and investigating

The teacher encourages the students to arrange the given resources in different ways in order to light the bulb.

Observing

The following questions may be useful in prompting the students in their work:

- *What does the wire have to touch?*
- *What does the bulb have to touch?*
- *Is one wire enough to light the bulb or do you need more wires?*
- *Can the battery be placed in different positions?*

Manipulating new resources

As this activity requires a sophisticated level of fine motor skills development, and as some students with mild general learning disabilities may not have the necessary finger dexterity, it may be useful to use a battery holder. In this instance, the students need to be shown how to attach the wire and bulb.

Conclusion of the lesson

Recording

Encourage the students to talk about their work as a means of recording. Alternatively, they may draw their work or present it by using the actual resources and perhaps labelling the various parts of the simple circuit.

Language development

Introduce the term circuit when the students have succeeded in lighting the bulb.

Extension activities

Experimenting and investigating

Encourage the students to think of a variety of ways to make the bulb go out still using the three resources supplied. Investigative work like this helps to consolidate the idea of a circuit and the necessity for the circuit to be 'closed'.

Predicting

This lesson can be developed further by providing the students with two wires. How can these be used to light one bulb?

Observing/communicating and sharing ideas and findings

Provide a second bulb.

- How can both bulbs be lit using the two wires and the battery?
- Do both bulbs light up as brightly as when only one bulb is used? Why?

(Bulb holders can be introduced to the students to make the manipulation of resources easier.)

Provide a second battery. What effect does this have on how the two bulbs light?

In all activities, encourage the students to predict prior to investigating and experimenting. The teacher can scaffold this process.

Exemplar 3: Science

Approaches to designing and making

Designing and making activities should enable the student with mild general learning disabilities to

- design and make objects that work
- express his/her individual sense of creativity and originality in the design process
- observe how things work and how they might be improved focusing on familiar everyday objects in order to see technology all around them
- take things apart in order to examine how they work or how they have been constructed
- develop craft-handling skills
- handle and work with a range of materials
- gain experience through closed and open-ended activities.

The following points should be considered when planning, designing and making tasks for students with mild general learning disabilities:

- Extensive opportunities should be made available to these students to use age-appropriate construction toys—up to and including sixth class.
- Regular sessions using construction toys can be used by the teacher to allow the student to become familiar and comfortable with the technique of the teacher as a talking partner who is questioning, observing, engaging in trial and error, and predicting on behalf of the student.
- The creative, fun element that encourages originality in design and construction should be given the same weight as the problem-solving aspect.
- In relation to open-ended tasks, the curriculum suggests that in infant and junior classes students may be presented with more focused activities. This may also need to be the case for older students with mild general learning disabilities. Rather than presenting them with a completely open option, it may be better to present them with a range of choices, some appropriate and some inappropriate, and to allow them to choose a design and to justify their choice.

The following section presents an exemplar on a designing and making activity that has been adapted for students with mild general learning disabilities. It is based on work that the students would cover in the strands *Energy and forces* and *Materials*. Using this approach, the students have opportunities to

- **revise new ideas encountered in previous investigations and activities in the two strands.** This revision is very important for students with mild general learning disabilities as their powers of recall and memory may not be as well developed as those of the wider student body. Reinforcement is important for them in sustaining their learning.
- **see the connections between different pieces of information.** In the case of this exemplar, they can be helped to connect their understanding of light and its properties with knowledge of the properties and characteristics of different materials.
- **use their knowledge and understanding in a practical manner.**

Exemplar 4: Science

Title: Designing and making

Level: Third and fourth class

As students with mild general learning disabilities can have short attention spans, this unit of work should be presented across a number of lessons.

Initial problem

It is a very sunny day outside. The sun is shining through the classroom windows. It is making the room very bright and warm, which in turn makes it difficult for us to continue working. Can we design and make some little blinds to stop some of the bright sunlight from coming into our classroom?

Background

Most of the students will have experiences of seeing blinds being used either in their homes, their school, or in other buildings. Most will also have the experience of wearing sunglasses and/or using head-band visors. These experiences collectively provide a rich starting point for the designing and making task.

Resources

A selection of materials all of which are familiar to the students, for example black felt, light-coloured cotton, transparent plastic, sheets of brightly coloured film, denim. Avoid a large selection of materials so that the students can make decisions more easily.

Sunglasses.

Head-band visors.

Glue.

Stapler.

Thumb-tacks.

Short wooden dowels/bamboo canes.

Scissors.

Craft-handling skills

This task provides opportunities to develop the skills of

- cutting
- joining.

Exploration

The students explore the blinds in the classroom: on the classroom windows, in the doll's house from the younger children's play corner. They also examine a selection of sunglasses and visors. They are encouraged to look at

- how good are different materials at keeping out the sun
- the types of materials used
- the colours of the materials.

It is important to keep the number of considerations to a minimum for students with mild general learning disabilities, in order to focus their attention on key issues.

Exemplar 4: Science

The teacher encourages the students to explore the different blinds, glasses, visors, etc. by touching them, by looking through them (taking care not to look directly at the sun), and by comparing one with another. The teacher can work as a learning partner in this phase through modelling exploratory techniques and by direct questioning and suggesting.

Planning

Through the teacher's role in the exploratory phase, he/she elicits ideas from the students on what materials would be best suited to a blind and why. In these discussions, the students can be guided to consider

- what shape the blind should be
- what size the blind should be
- the size of the window section to be covered by the blind (either by demonstrating at the window or using a template to indicate the size)
- how the blind should be attached to the dowel/cane
- how the blind should be attached to the window
- how the blind can be made more attractive.

Where difficulties arise, the teacher offers solutions, makes suggestions etc.

In responding to the above questions, the students may prefer to make drawings of their plans rather than to verbalise their intentions. Alternatively, they may prefer to demonstrate their plan using the materials available. These various modes of communication should be accommodated.

Making

Having planned their task, the students work on making their blinds.

The students will require support, encouragement and guidance from the teacher during the making process. The teacher should give particular attention to aiding the students in attaching the material to the dowel/cane, as this skill can be challenging for many students with mild general learning disabilities. Without sufficient assistance from the teacher students can become frustrated with the task and give up easily and quickly.

The students are given sufficient time to 'decorate' their blinds. As with the initial designing and making task, they should be given a choice of resources for this task:

- felt-tip pens
- paints
- stickers
- fabric
- crayons, etc.

Exemplar 4: Science

Evaluating

The teacher helps the students attach their blinds to the classroom windows.

The students are encouraged to assess the effectiveness of the blinds in keeping the bright sun out of the classroom. Through questioning, suggesting, surmising, etc. the teacher facilitates the students in this task. They are encouraged to consider how they could improve their designs. Care, however, must be taken to value each student's work irrespective of its effectiveness in the task.

The blinds should be left on the windows. Their effectiveness, their durability and their functionality will become more apparent to the students over time. Additionally, on dull days, the problem of keeping the blinds 'up' will become more obvious. To facilitate this, the students may suggest adding short ties to the blinds which can be fastened and unfastened depending on the type of weather in question.

The students should be encouraged to link their findings to the everyday use of blinds on windows.

Exemplar 5: Science

Strand: Designing and making

Level: Third and fourth class

This exemplar builds on Exemplar 3 that outlines a unit of work on electricity for students with mild general learning disabilities. It indicates how a designing and making task can emerge from the strand units of the curriculum.

As with Exemplar 5, this unit of work may be better presented across a number of lessons for students with mild general learning disabilities.

Initial problem

Can we make a clown face with a nose that lights up?

Background

Most of the students will have seen clowns or clown faces either in reality, or in pictures and books. These experiences give them an awareness of the shape, and features of a clown's face, such as the red nose, smiley mouth, fuzzy hair, etc. The unit of work on lighting bulbs and building simple circuits provides opportunities for the student to learn about the use of circuits to light up a clown's nose.

Resources

Sheets of red cellophane/red cellophane wrappers from chocolates.

Paper.	Card.
Scissors.	Bulbs.
Batteries.	Wires.
Bulbholders.	Battery holders.
Screwdrivers.	Felt-tip pens.
Paints.	Scissors.
Glue.	Stapler.

Craft-handling skills

This task provides opportunities to develop the skills of

- cutting
- joining and attaching
- making holes.

Exploration

The students explore the materials provided. It is advantageous to allow them to build simple circuits again to reinforce how this is achieved. They can be encouraged to consider:

- How can the bulb give a red glow to the clown's face?
- Does the bulb need to be attached to the clown's face?
- If so, how will we attach it?
- How can the nose be made to light up and switch off?

As before, keep the number of considerations to a minimum for these students.

Exemplar 5: Science

Planning

The students plan how they will make their clown faces with noses that light up. This may necessitate the teacher acting in a facilitative role by offering suggestions, asking questions, directing the students' attention to particular resources, etc.

The students are encouraged to decide on the most appropriate materials for their task. Their attention may need to be directed to the shape of the clown's face, the size of this shape, and the size of the hole for the nose. The students can use a variety of means to articulate their plans:

- drawing
- verbalising
- modelling.

Making

Having planned their task, the students work on making their clown faces.

The students will require support, encouragement and guidance from the teacher during the making process. Particular help may be needed in cutting the hole for the nose and in attaching cellophane to either this hole or to the bulb, depending on the student's design. In constructing the simple circuits needed for this task, it will be easier for the students if they are familiar with using bulbholders and battery holders. These resources and their uses will have been introduced to the students in their work on electricity. The teacher may need to assist some students who do not have the manual dexterity to use a screwdriver to connect the wires to the bulbholder.

The students should be given sufficient time to 'decorate' their clown faces.

Exemplar 5: Science

Evaluating

Allow the students time to play with their own clown face, and to explore each other's work.

The students are encouraged to assess the clown faces with particular attention to how well the noses light up. Encourage the students to identify difficulties they encountered in the task through asking questions:

- *How do you make the clown's nose light up?*
- *Is this easy?*
- *Is it easy to move the face, the battery and the bulb from one desk to another?*
- *Is the nose bright when it lights up?*
- *How could the nose be made brighter?*
- *Is it easy to switch the 'glowing nose' on and off? (This might lead to suggestions on how to make simple switches.)*

These questions encourage the students to consider how they could improve their designs.

Leave the clown faces on display.