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# 2

## Addressing Specific Learning Difficulties

### INTRODUCTION

Logically, before one begins to fix something, it is best to know as much as possible about what it is that needs to be fixed. Preparing for differentiated science instruction is no different. In the case of preparing for differentiated science activities, assessments and so forth, the teacher seeks to revise (more so than “fix”). Exactly what those revisions entail depends upon the intended target audience. In the science classroom, that audience is the student. If activity and assessment revisions are to hold promise of success, teachers require a clear understanding of students’ needs and learning characteristics. In this chapter, those specific learning difficulties are briefly examined in order to provide teachers some context in which they can then proceed to make necessary and appropriate revisions in their instructional science materials and procedures.

### VIGNETTE WITH MS BURRELL

Ms Burrell was taken aback by Joel’s behaviour. Whenever the class was at their lab stations, it seemed Joel would intentionally break a piece of glassware or be across the room poking at another student. If not that, then he’d be disorganising the materials at his workstation so his lab partners would have trouble getting through the activity. Letting this behaviour continue was no way to run a year six class. So, Ms Burrell decided to create some special rules for Joel to follow. First, during lab times, he would have to stay in a designated space at his work area unless he needed to go retrieve or return materials from the supply table. Second, he would only be allowed to manipulate one thing at a time and must leave other materials in their place on the worktable until it was their turn to be used. Third, Joel would be given only nonbreakable items to use—no more glassware, if at all possible. As Ms Burrell reviewed her “Joel rules”, she realised that these rules could also be helpful to other students. In fact, she had several other students who had some behaviour and learning issues (although not as extreme as Joel’s). And, it would be better to have rules that applied to everyone rather than singling out one student—more equitable application, that way.

Ms Burrell thus began implementing the new rules, and found the lab area was sometimes (but not always) much calmer and the students were more productive (but not always)—not to mention safer. Moreover, Joel’s behaviour during labs showed improvements as well. In the following section of this chapter, you will find some guidelines that specifically address what Ms Burrell desired to do—as well as other guidelines to improve operations in her classroom.

## PREPARING TO MAKE INSTRUCTIONAL CHANGES

In order for Ms Burrell to devise a plan of action to deal with Joel's behaviour, she first needs to understand something about the characteristics of behaviour disorders. Chapter 1 presented information about various learning needs, including behaviour disorders, that would be helpful for Ms Burrell. Whenever teachers make changes in activities or assessments, it affects learning outcomes for all their students, especially for those who have learning differences. Although it is impossible to predict what type of changes will be effective for all students, teachers should attempt to be as fair as possible in making those alterations. Some teachers use a trial-and-error method to determine task adaptations that will result in all students achieving academic success in the classroom. Ms Burrell may find it helpful to consult her special education colleague about Joel's situation, as well as his IEP or 504 plan, to identify the strategies that have the best chance for success.

Teachers like Ms Burrell are likely correct in their thinking that the changes in classroom rules might be beneficial to all their students, although they should be mindful that not all such changes impact every student in the same way. Some students will still need their own special rules to follow. Further, unless teachers understand the particular difficulties their students face with writing, reading, comprehending and so on, teachers' rules may lack the effectiveness they desire. Teachers need to address the difficulties themselves rather than their symptoms (such as negative classroom behaviours).

Teachers will also find it necessary to change some of the personal protocols and procedures in their own teaching. For example, they may reorganise their course schedules so that they give tests on Tuesdays, Wednesdays or Thursdays, rather than on Mondays or Fridays. Mondays are particularly problematic for students who take medication. Often, the medicine is not given on the weekend for various reasons. It may take several hours for medications to take effect on Monday mornings when students resume their medications. Teachers may also need to be more judicious in selecting work partners for their students. Work partners may be available adults (e.g. paraprofessionals, parent volunteers) or other students who are interested in being assistants. Teachers should not hesitate to seek assistance in meeting the varied needs of their students, including those with special needs.

Chapter 1 examined major categories of special learning needs, and many teachers will recognise how some of their students exhibit specific difficulties that seem to cut across these categories. For example, they may find students with attention deficit disorder (ADD) and learning disabilities (LD) both have some difficulty with writing while students with autism spectrum disorder (ASD) may struggle with comprehending textbooks and gaining information from class lectures. The remainder of this chapter looks at considerations teachers should make, as they plan their science instruction, regarding specific difficulties their students may have. Some suggestions can apply to more than one difficulty students experience in their science learning.

## CONSIDERATIONS FOR STUDENTS POSSESSING WRITING DIFFICULTIES

Many students with learning challenges experience difficulties with writing, both the physical and the cognitive processes. As students progress through the science curriculum, writing demands increase. By the time they are in middle years, science students are expected to be able to write answers to questions, listen to a teacher's presentations and take notes, complete lengthy exams using multiple answer formats and prepare written reports. Difficulties in writing may include being able to produce clear, legible answers or products as well as preparing well thought out and constructed responses to academic tasks. Some students with learning difficulties also have poor fine motor skills, particularly in the early primary years, and may have very slow, laborious writing that impedes their completion of tasks in the same time frame as their peers.

Teachers can provide assistance to these students in various ways. With the technology available in schools today, one solution is to allow students to use computers or word processors to do their written assignments. By allowing the use of a computer, the student may be a much faster typist than writer, and this strategy emphasises clarity as well. In addition to addressing the physical demands, a computer can also assist in improving potential mechanical and composition concerns by employing the spell- and grammar-check tools. This can be a motivating method of writing for two reasons. First,

computers facilitate the writing process for students; it is not so much physical effort, and it can assist students in organising their ideas (Access Center, 2004). Second, the completed writing project will be more readable, polished and better in quality (Lipson & Wixson, 2003).

Another digital option for teachers is to allow students to audio-record their answers. With this response mode, students will record their answers to questions or complete tasks orally using a tape recorder for later transcription or computer software that uses word recognition technology. Teachers may find student answers are much more complete compared to those they get when students physically labour with writing. If the technology is unavailable, the student can dictate to an adult (such as a teaching assistant or volunteer).

One of the biggest challenges for students with learning difficulties is taking notes during teacher presentations. Note taking is an important skill for students and teachers should help students with this for many reasons, including because it helps students understand and remember instructional information, it keeps students engaged in the learning process, and it improves students' performance on tests. Thus, it is important for students with special needs to learn how to take notes effectively. To facilitate note taking for students with special learning needs, teachers can provide outlines of their lecture notes to students or audio-record their lectures so those who need it can listen to the presentation again.

Additionally, unless prescribed by IEPs, 504 plans or NAPLAN test protocols, teachers can use performance-based assessments rather than paper-pencil tasks or tests for students to demonstrate skill mastery. Teachers may find that some of their students are more relaxed and can demonstrate their learning more effectively through a more authentic task than through an abstract writing task or formal test. For example, if teachers want to assess whether students know the parts of an atom, they can ask them to draw and label the atom in lieu of one or two multiple-choice items on a test.

## CONSIDERATIONS FOR STUDENTS POSSESSING READING DIFFICULTIES

Reading is a very complex task, and for students with learning challenges often represents difficulties. Reading is not a single process, but instead is comprised of the simultaneous implementation of several operations that address decoding (which includes phonemic awareness and phonics), and comprehension (vocabulary knowledge and fluency). Good readers apply all of these skills to written text to gain meaning and acquire information. Neuroscience (Medina, 2008) has shown us that the human brain doesn't read whole words or individual letters, but rather interprets graphic portions—such as the vertical portion of the letter *R*, the individual horizontal portions, the slanted portion, and so on. When seeing the letter, the brain must put the images of the portions of the letter together in order to recognise it as the letter. Once decoded, the student then continues to apply phonics' rules, and ultimately derives meaning (comprehension) from the print. Hence, reading is a very labour-intensive process.

Science reading materials can usually be placed into one of two kinds of text: narrative or technical. Technical reading is characterised by much information, definitions, terms and so forth. Narrative reading is characterised as more storytelling, much like what one finds in trade books. Each requires different types of reading skills that need to be taught, and technical reading is particularly difficult for many students.

To help students use written science material effectively, teachers should consider potential barriers for those students who deal with printed materials less effectively because of special learning needs. Many of the difficulties that students with special learning needs encounter relate to the mechanics of reading, including the size and print quality of the text or learning materials. When providing reading material for students, teachers should type the materials, with a font that is as clean as possible with few or no tails (serifs) such as Geneva or Helvetica. Fonts of 12 to 14 point are easier for students to work with than are smaller font sizes. In addition, double-spacing print helps students track the text better. In addition, teachers should avoid glossy paper selected for printing or copying learning materials. Flat-finish papers reduce visual glare and are easier on the eye. (Many textbook pages are printed on glossy paper because it helps with coloured text and figures.) Some coloured papers work well for copying, particularly if they are softer tones.

Teachers report wide variability in student reading level, and this is also true of students with special learning needs who are placed in general science classrooms. That is, some of these students will

example, to reduce the trials to two or three rather than five or six. In some instances, reduce the number of trials to one or two. While some science educators will debate this point, a key, regardless, is to have students conduct as many trials as necessary to derive a set of usable data that conveys the basic concept or idea to them. It may be unnecessary to have students repeat ten or twelve trials of an event when three to five would suffice.

20. Give partial credit whenever possible, and consider modifying marking requirements, according to the abilities of individual students and according to their IEPs or 504 plans.

## REVISING WRITTEN AND PRINTED MATERIALS

### Selecting and Changing Written Materials

When science teachers attempt to accommodate students with LD, their first concern should be the types of instructional materials they use. In particular, determining a good fit of textbooks and other materials requires teachers to analyse instructional materials for (1) the reading level, (2) the visual accessibility, (3) the use of visual cues, (4) the organisation of materials and (5) the substitution of more appropriate items. Suggestions follow for determining the use and effectiveness of science materials for students with special needs.

### Selecting and Adapting Textbooks

Since many science activities are located in textbooks, or student manuals that accompany textbooks, teachers may find it necessary to consider criteria for selecting and adapting such materials. As a beginning point, teachers should determine the readability level of the textbook. They might use a readability formula to determine the reading level and difficulty of any textbooks or materials they are using. Two examples are the cloze procedure and the Fry Test for Reading Levels. However, depending upon the science terms present in the passages analysed, a teacher may find a variation of one year level up or down in the results obtained—so some caution is warranted.

Once teachers have established the readability level of the text or other written material they plan to use, they next need to determine the degree of *considerateness* of the textbook. Text considerateness is the accessibility and usability of a book. Teachers should evaluate the text by reviewing all of the features of the book. For example, looking at text features, does the book pose prereading questions to help the student prepare to read the content? Are headings and subheadings used to organise the chapters? Does the author use bolded vocabulary, pictures and diagrams to help the student identify key ideas? Finally, is the textbook written in a way that is motivational for students?

Finally, teachers should prepare students to use the textbook. At the beginning of the school term, they should review the textbook with students to teach them how to use the text. This may mean spending several days acquainting students with the text through activities such as a scavenger hunt that requires students to find information using all of the features of the book.

### Substituting the Text

Sometimes, the text (textbook, handout, etc.) is far too difficult for students with special needs. In fact, many students with special needs have reading levels up to three years below their year level placement. In these cases, it is difficult, if not impossible, for those students to acquire information effectively from the textbook. When this occurs, science teachers may need to consider substitutions for the class science text. How much teachers can do in these instances may be limited by an individual student's IEP or 504 plan, so teachers should be sure to check that document before proceeding. Provided teachers can substitute the text, they can consider the following suggestions for providing information in science books or other text material:

1. Audio-record the science text. A fairly simple answer for students experiencing difficulty with a textbook is for teachers to provide a recorded version. If the student has an identified learning disability, recorded books can be requested through Readings for the Blind. If the student is not in special education or is not registered with Readings for the Blind, then teachers can arrange for the text to be recorded at the

school by a teacher's aide, a student or a volunteer. Some publishers may also provide their books in audio formats. In either case, it is prudent to check with the publisher to avoid infringing on copyrights.

2. Read the text aloud to students. One way to address the reading difficulties of all students is to provide time for the textbook to be read during instruction—in large groups, small groups or pairs. By having students read the text aloud, teachers can ensure that all students are reading the assigned material and even conduct follow-up comprehension activities. While this takes a great deal of time, the benefits to students who have difficulty reading assigned materials are potentially large.

3. Pair students to master text content. Teachers might assign students to work in pairs to complete activities that demonstrate comprehension of the text materials. Students with special needs tend to work well in small groups or pairings. One hint when pairing students is that partnerships will be more successful when the students are more alike in their academic skills (i.e. pair a student with a low reading ability with one who is slightly higher, but not dramatically superior in academics). This reduces the dissonance in skills and eliminates the potential for one partner relying too much on another. However, when assigning small groups, make sure the groups are heterogeneous in skills, gender and culture. Avoid having high, medium and low groups.

4. Construct abridged versions of text content. Teachers may wish to rewrite the text and eliminate difficult terminology, reduce sentence length and remove extraneous material. When rewriting a text, the focus should be on presenting the key ideas in a clear manner and providing very specific examples for each concept.

5. Provide an overview of an assignment before reading. An excellent teaching technique for improving comprehension is to provide an overview of the concepts that will be encountered in the assigned reading. A prereading activity can be used to present vocabulary, connect previously learned information to new material, present prediction questions and organise the students' approach to the reading.

6. Structure opportunities for students to activate prior knowledge before they start reading the assignment. Student comprehension increases when the information encountered is familiar and relates to previous experiences. Thus, teachers can increase comprehension by helping their students make important connections between new and old concepts. This can be done quite easily by taking a few minutes to preview the reading assignment and review pertinent information that was previously taught.

7. If the text does not have one, teachers can develop a reading guide to direct learning from it. (Some textbooks include such guides, alleviating the need for teachers to do this.) This makes content reading more structured for students. A reading guide may be a list of questions students are to answer as they are reading, or may be a set of competencies the student should be able to meet after reading the assigned material. The guide should be set up sequentially so students can use it as a road map through the materials. If the reading guide consists of questions, those may need to be reworded. Some students have difficulty understanding the vocabulary used in review questions found at the end of chapters. Teachers can increase student responses by rewriting the questions using more understandable or less complex vocabulary. The idea is not to reduce the number of questions that the student is to answer, but rather, to use vocabulary that the student understands. Additionally, teachers may find it helpful to students if they provide them with clues for finding answers to text questions. For students who have difficulty manipulating texts, a simple way to help them find answers to text questions is to give them the page number where the answer can be found. This gives students a running start, but still requires them to read and find the appropriate answer.

8. Highlight key ideas in texts. For students who have difficulty distinguishing important concepts in reading materials, teachers can help by highlighting those terms or language that represent pertinent information. Teachers may select two or three texts for each class, highlight those texts, and use them each semester or year with those students who need the extra guidance. If teachers plan to highlight textbooks, they may need to first obtain approval from their administration before marking in any books purchased by their school.

9. Divide reading into smaller portions and distribute them over time. Many students with special needs have reading fluency and rate problems that cause them difficulty in completing reading assignments in limited time frames. Therefore, teachers might consider distributing a reading assignment over a week's time rather than assigning a lengthy chapter to be read in one night. This will help the student

## SILENT SMELL TRACKING

### Introduction

Wolves, like many animals, rely on their senses for learning. Almost from the time they are born, wolf pups use their sense of smell to tell them where they are and to help them find their mother for each meal. To wolves, like other animals, the sense of smell is often more sensitive than it is in humans. For example, although we might be able to detect smells in the air like perfumes or smoke, wolves can sense odours much earlier and in more diluted quantities than we can. Animals often mark their territories by leaving scents that other animals can smell. Further, animals can identify their relatives by their individual smells. The scents come from glands located in various places on the wolves' bodies: the base of the tail, the skin, their feet and so on. Wolves often spread their scent by rubbing parts of their bodies against trees.

In this simulation, you will be lost wolf pups. You will try to find your mother, or your den, as well as other members of your wolf pack by using your sense of smell.

### Objective

After completing this activity, the student should be able to

1. determine how the sense of smell can be used to learn about an object.

### Materials

6 cotton balls per group	6 food extracts (e.g. lemon, vanilla, etc.)
6 35-mm film canisters with lids per group	6 colour dots per group (same colours per group, different colours for different groups)
1 box	

### Procedures

- A. For each group of five students, open six 35-mm film canisters. If you wish, mark the bottoms of each canister with a colour dot. (If you do this, be sure to not tell students so they will not simply match colour dots later in the activity.) One canister will be the "mother" or "den" scent while the others are for the wolf pups.
- B. Take six cotton balls and soak each with the same food extract (e.g. vanilla).
- C. Place one cotton ball in each film canister, and then fasten the lids on each canister.
- D. Repeat Procedures A, B and C for different groups, using a different food extract for each group.
- E. Place one film canister of each scent (food extract) randomly around the room.
- F. Mix up all the remaining film canisters. Place them in a box.
- G. Have students reach into the box and withdraw one film canister each.
- H. Tell students they are to remove the top of the film canister and smell what is inside. Then, instruct students to do the following two things *without speaking to one another*:
  1. Find all the other members of their pack.
  2. Find their den.
- I. Advise students to remove the lids of their film canisters to smell each other (each others' scents) as well as the canisters representing the dens and mothers. However, advise students to keep the lids on their canisters when they are not smelling the scents.
- J. As an option, extend this activity by having students smell their individual scents for long periods of time (such as two minutes) and then try to locate identical scents. (The olfactory sensors in the nose will become fatigued, and for a while, will fail to respond to scents of the same kind.)

### Source

Barber, J., Barrett, K., Beals, K., Bergman, L. & Diamond, M.C. (1996). *Learning about learning*. Berkeley, CA: Great Explorations in Math and Science, Lawrence Hall of Science, University of California.



## SILENT SMELL TRACKING

### Teacher Introduction

This first page is for the teacher only. The essence of the activity is that animals, such as wolves, have scent glands and they use their particular scents to identify each other as well as their territories. Students will use scents to locate their wolf mothers and dens during this activity.

### Materials

- 1 box
- 6 cotton balls per group
- 6 food extracts for smells (e.g. lemon, vanilla, peppermint, etc.)
- 6 35-mm film canisters with lids per group
- 6 colour dots per group (same colours per group, different colours for different groups)

### Teacher Preactivity Preparation

1. For each group of five students, open six 35-mm film canisters. If you wish, mark the bottoms of each canister with a colour dot. (If you do this, be sure to not tell students so they will not simply match colour dots later in the activity.) One canister will be the "mother" or "den" scent while the others are for the wolf pups.
2. Take six cotton balls and soak each with the same food extract (e.g. vanilla).
3. Place one cotton ball in each film canister, and then fasten the lids on each canister.
4. Repeat Procedures 1, 2 and 3 for different groups, using a different food extract for each group.
5. Place one film canister of each scent (food extract) randomly around the room.
6. Mix up all the remaining film canisters. Place them in a box.

### Note for Procedural Step 4

The olfactory sensors in the nose will become fatigued and will fail, for a while, to respond to scents of the same kind.

This particular activity includes a teacher's page. This page provides information about necessary preactivity preparations, as well as an informational note about the last procedure in the activity.

- Although not readily apparent here, the font has been changed. The font selected is one with few serifs (curlicues) on the tails of letters. In addition, the font size increased to 14 point.

**Silent Smell Tracking**

**Page 3**

**Procedures**

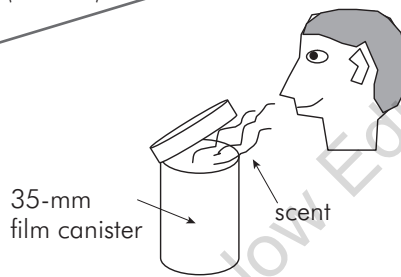
**Step A**

- \_\_\_ 1. When it is your turn, **reach** into the teacher’s box of canisters and **take out** one film canister.
- \_\_\_ 2. **Wait** until everyone has picked a film canister.
- \_\_\_ 3. **Remove** the cap of your film canister.
- \_\_\_ 4. **Move the canister** close to your nose and **smell** what is inside the canister.
- \_\_\_ 5. Try to **identify** the scent you smell.

**Question for Step A**

a. What do you think the scent is (name it)?

Scent name:



The procedures are divided into four major steps, with each step formatted to have its own section in the activity.

Procedures within each step are provided. This simplifies the longer directions given in the original activity.

A diagram is added to help students visualise what they are being asked to do.

Dashed lines now help students distinguish between the steps.

**Step B**

- \_\_\_ 1. **Find** your family wolf pups.
  - \_\_\_ 2. **Do this WITHOUT SPEAKING** to one another.
  - \_\_\_ 3. **Go to other students and smell** their film canisters. When you **find a matching scent** for the smell in your canister, **stay** with that person.
- NOTE:** Keep the lid on your film canister unless you are smelling it or having someone else smell it.
- \_\_\_ 4. When you **find** someone with the same scent as you have, **continue to search** for other members of the family. **Continue until** you have found all family members (there should be five total in a family).

Each step is clearly identified with its own subheading (Step A, Step B, etc.)

- The entire content of a section or step is kept on the same page, so part of a step isn't on one page and the rest of it on the next page.