4.3 USING EXAMPLES TO PROMOTE LEARNING

4.3.1 INTRODUCTION

In a study of learners' use of embedded devices, the most popular device was found to be examples (Martens, 1998). It is therefore odd that many texts on writing ODL materials have no discussion on examples. Says Romiszowksi (1986), 'The power of example is often underrated in education and training. Teachers spend too much time "telling" and not enough time "showing".'

In this handbook, examples are considered to be of similar importance to activities and it is recommended that instructional designers include as many examples as are feasible in any given piece of ODL.

Issues for instructional designers

1. What sort of things do I need to provide examples of?
2. What makes good examples?

4.3.2 WHAT SORT OF THINGS NEED EXAMPLES?

Examples are most important at the comprehension and application levels of Bloom's taxonomy (see section 3.3, 'Setting Aims and Objectives for Your Course').

At the lowest level, knowledge, examples are not possible. If you are trying to teach the fact that the name of the ocean to the west of Africa is the Atlantic Ocean, all you can do is state that fact. You cannot give an example of 'Atlantic Ocean', although you can show the ocean itself.

At the comprehension level, examples are used to help learners understand new ideas and methods. At the application level, examples are used to help learners use the learning that they have acquired. Table 17 summarises the use of examples at these two levels.

TABLE 17. Where examples are most needed

Category	Material for which examples are needed	Purpose of examples
Comprehension	Concepts	To aid understanding
	Rules	
	Principles	
	Procedures (algorithms)	
Application	Use of concepts	To develop proficiency in application
	Use of rules	
	Use of principles	
	Use of procedures (algorithms)	

4.3.3 HOW TO GIVE EXAMPLES OF CONCEPTS

Concrete (primary) concepts

Concrete concepts are ones that refer to real things or situations and that cannot be broken down into further concepts. Examples of concrete concepts include colours, distance and light.

The following steps should be used to teach a concrete concept (e.g., the concept of blue):

- Show some examples of things that possess the property ‘blue’ alongside some things that do not possess this property. Make sure that all the blue objects are clearly blue and all the non-blue things are clearly not blue (i.e., avoid cases where it is hard to say whether the object is blue or not).
- Test the learners by presenting some further (clear-cut) examples of blue and non-blue objects.
- Once the learners have mastered the basic concept, continue presenting finer distinctions up to the point of understanding that you wish to reach.

Defined (secondary) concepts

Defined concepts are ones that are made up of other concepts. Examples of defined concepts are triangles, money and house.

There are two main ways of teaching defined concepts:

1. **example-rule method** – This method should always be used with children and can also be used with adults.

    - Show some examples (e.g., some triangles) and non-examples (e.g., some other shapes).
    - Ask the learners to work out what the rule is that makes the concept (e.g., 'triangles have three sides').
    - Test for understanding.
    - If the learners' definitions are not exactly correct, challenge them by presenting some cases that do not work under their definition.
    - Continue to refine until learners reach the degree of discrimination that you require.

    To see instances of teaching by the example-rule method, see Examples 30, 31 and 32.

2. **rule-example method** – An alternative way of teaching is to first state the rule and then to give examples (Romiszowksi, 1986; Rowntree, 1990). This method should only be used with learners who have a reasonable capacity for learning in an abstract way.

    - State the definition and give some examples and non-examples.
    - Test for understanding by presenting further examples and non-examples.
    - Continue to refine until learners reach the degree of discrimination that you require.

EXAMPLE 30. Finding rules from example data

Discovering the exponential rules

In algebra classes, learners get very confused trying to remember the rules of exponents. For example, when you raise numbers to powers, do you add or multiply the exponents? It is important to explore working with exponents on whole numbers rather than with letters or variables. By doing so, learners are able to deal directly with the concept and actually generate the rules themselves.

Try to discover the exponential rules by doing the following activity:

Activity 3

(1) If $x = 3$, $y = 2$ and $w = 5$, find:

(a) $5y^2$ (b) $(5y)^2$ (c) $2x^2$ (d) $(2x)^2$ (e) xy^2

(f) yx^2 (g) $yw^2 - wy^2$ (h) $(w-y)^2$ (i) $2w - y^2$ (j) $w^2 - x^2$

(2) First write the following out (expand) and then in short form.

(a) $a^{13} \times a^2$ (b) $a^{24} \times a^2$ (c) $a^{33} \times a^5$ (d) $3a^4 \times a^3$

(3) Write in short form:

(a) $a^5 \times a^7$ (b) $a^8 \times a^{12}$ (c) $a^{40} \times a^{50}$ (d) $n^{30} \times n^{70}$

Exponential rule 1

- To **multiply** powers of the **same base**, **add** the exponents

(1) $3^4 \times 3^3 =$ .....

(2) $y^4 \times y^2 = y^{4+2} = y^6$

(3) $a \times a =$ .....

In general, $a^m \times a^n =$ .....

Source: *Trigonometry, Algebra and Calculus*. NPD030-A (UNISA)

EXAMPLE 31. A well-presented example being used to teach rules

Theodoric Office Furniture (1)
19 High Street, South Reading, Berkshire RG1 2NH
Tel: 0118 954 4156 Fax: 0118 954 4178
VAT REG NO 352–2327-75

INVOICE

(2)
To: Wentworth plc
56 Highbury
Industrial Estate
Reading
Berks
RG2 9PQ

(3) Date & Tax point: 31 October 1998
(4) Our ref: 7812/3
(5) Your ref: O/No. 0943A

(6) Qty	(7) For	(8) Cat.	(9) Price £	
14	Grey office chairs @ £89	OC4G	1,246.00	
3	Teak 3-drawer desks @ £315	TD2N	945.00	
			2,191.00	(10)
		Less discount 2%	43.82	
		Sub-total	2,147.18	(11)
		VAT @ 17.5%	375.75	
		Total	2,522.93	(12)

(13) Terms: 30 days net monthly
(14) E&OE

This invoice shows the name and address of the sender ① and the recipient ②, and the date ③ – these are all straightforward. It has two references:

- the sender's reference ④, which is the invoice number and will be used to identify the invoice on a statement and in the accounts
- the recipient's reference ⑤, which in this case is the number of the order that Wentworth sent to Theodoric Office Furniture.

Putting the buyer's reference on the invoice makes it easy for the buyer to find the right order and check the invoice against it. Invoices which don't match any order won't be paid as there is no evidence that the organisation ever ordered the goods.

The main part of the invoice shows what Theodoric has supplied. The first column shows how many of each has been sent ⑥, the next describes the goods and

Source: *Essential Book-Keeping* (National Extension College, Cambridge)

EXAMPLE 32. An example being used to teach a method

Example

Solve for x and y:

$$x - y = 5 \quad \ldots\ldots\ldots\ldots (1)$$
$$x^2 + y^2 = 97 \quad \ldots\ldots\ldots (2)$$

Solution

$x = y + 5$ ..... (3) *(Solve for x, using the linear equation (1).)*

$(y + 5)^2 + y^2 = 97$ *(Substitute (3) into (2).)*

$y^2 + 10y + 25 + y^2 = 97$ *(Solve for y.)*

$2y^2 + 10y - 72 = 0$

$y^2 + 5y - 36 = 0$

$(y + 9)(y - 4) = 0$

$y = -9$ or $y = 4$

(Now find x by substitution for y in (1).)

If $y = -9$, $x = -4$ If $y = 4$, $x = 9$

$\therefore$ The solution is (-4; –9) or (9; 4).

Source: *Trigonometry, Algebra and Calculus*. NPD030-A, p. 94 (UNISA)

Frequency of use

Before we leave concept learning, it is useful to note that the more connections that learners are asked to make between a new concept and other concepts, the better the concept will be learned (Bligh, 1998). This means that you need to offer students multiple opportunities for making further reference to that concept as the course progresses. The spiral curriculum (see section 3.5, ‘Methods of Ordering Content’) is an effective way of doing this.

4.3.4 HOW TO GIVE EXAMPLES OF RULES AND PRINCIPLES

Rules and principles basically take the form:

if A, then B

where A and B are each concepts (or collections of concepts). Some examples of these are given in Table 18.

TABLE 18. Some examples of rules and principles

Example	Concepts involved[1]
If you cut yourself, you should wash and disinfect the wound.	A: cutting yourself B: washing and disinfecting
If there is traffic coming, you should not cross the road.	A: the arrival of traffic B: crossing the road
If a plant flowers on last season's growth, prune it straight after flowering.	A: flowering on last season's growth B: prune after flowering

[1]Each underlining is a separate concept, hence 'cutting yourself' involves two concepts.

Rules and principles are generally easy to learn, provided the underlying concepts are well understood. To teach rules and procedures (Romiszowksi, 1981):

- State the rule or procedure.
- Give some examples.
- Ask learners to apply the rule or procedure to some other examples.

4.3.5 HOW TO GIVE EXAMPLES OF PROCEDURES (ALGORITHMS)

A procedure (also known as an algorithm) has the following characteristics:

- It is used to solve a well-defined class of problems.
- It has a set series of operations, applied in a defined way.
- The operations are (individually) fairly simple.

Examples of procedures include:

- calculating an average,
- baking a cake to a given recipe, and
- diagnosing appendicitis.

One of the common features of procedures is that they represent accumulated, consensual knowledge of the best way to approach a given class of problems. There are two ways to teach procedures:

- **inductive** – Show the learners the steps.
- **deductive** – Expose the learners to some simple examples from which they discover the procedure.

Inductive teaching of procedures

The steps in the inductive method are set out in the left-hand column below. The second column shows how this would work for teaching 'calculate an average'.

Step	**Example**
Explain the procedure to learners.	This is how you calculate an average. You add up all the numbers … etc.
Demonstrate the method with one or more examples. The examples must be very straightforward.	I will find the average of 3, 7 and 5. First, I add up the numbers: 3 + 7 + 5 = 15 etc.
Ask the learners to apply the method to some straightforward examples.	Now you try this example …
Repeat (if needed) with more complicated examples.	

This is thought to be the better method to use for procedures that learners will use frequently.

In some cases, procedures may only be presented as information, rather than taught in more detail. Example 33 illustrates this approach.

EXAMPLE 33. Inductive teaching of a procedure

It is vital that you have a written Fire Procedure that everyone understands and is familiar with. An example of a Fire Procedure is shown in Figure 1, below.

IF A FIRE BREAKS OUT:

1 Sound the alarm

2 **Call the Fire Brigade (999)** – better to be safe than sorry!

3 Locate the fire – using the panel at the base of the stairs, if necessary.

Always feel the back of the door or the door handle – using the back of your hand – before you open a closed door. If hot, DO NOT OPEN, and GO INTO PHASED EVACUATION IMMEDIATELY.

4 Attack the fire, if it is safe to do so, using the fire extinguishers and the fire blanket.

5 If the fire can't be contained, then go into a phased evacuation.

PHASED EVACUATION PROCEDURE:

Phase 1

If you decide to enter the room in which the fire started, move people from the room, closing the door behind you.

Phase 2

Evacuate residents by way of the staircases or other routes as necessary. Take residents to other unaffected areas within the building, closing all doors behind you.

Phase 3

Total evacuation of the Home to a place of safety outside the building – preferably the pre-arranged assembly point at the front of the building.

ADVICE FOR MOBILE RESIDENTS:

1 Leave the building by the nearest exit. DO NOT stop to collect any belongings.

2 Close all doors behind you.

3 Report to the assembly point which is AT THE FRONT OF THE BUILDING.

4 DO NOT RE-ENTER THE BUILDING FOR ANY REASON until you are told it is safe to do so.

Figure 1: Sample Fire Procedure

First Aid arrangements

In accordance with the Health and Safety (First-Aid) Regulations 1981, workplaces should have First Aid provision. Ideally:

- when people are at work (including nightshift) there should be at least one appointed person who can take charge in an emergency situation – e.g. calling for an ambulance
- the appointed person should receive HSE-approved emergency First Aid training, plus Refresher Training every three years
- a First Aid box should be provided and should contain only the items that a First-Aider has been trained to use – the First Aid box should not contain medication of any kind
- all incidents should be recorded by the appointed person – name of the casualty, date, time and circumstances of the incident, the injury sustained and the treatment given.

Source: *Manager's Toolkit: Managing Operations* (National Extension College, Cambridge)

Deductive teaching of procedures

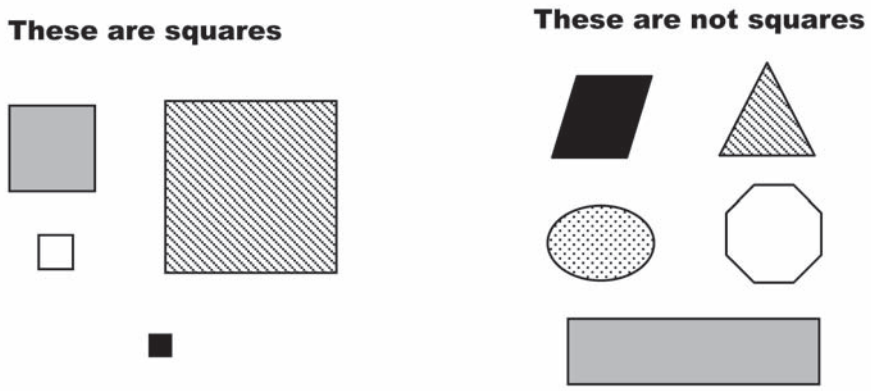
- Explain the problem to the learners (e.g., how can an average be calculated?).
- Give the learners some very simple data/examples to work on.
- Ask the learners to deduce the procedure.

This is thought to be the better method to use for procedures that learners will use rarely (Romiszowksi, 1981).

4.3.6 THE USE OF NON-EXAMPLES

When teaching concepts, it is important to give both examples of the concept and non-examples of the concept. For instance, Figure 10 shows how to teach the concept 'square'. Four squares are shown on the left-hand side, but these alone are not enough to avoid misunderstanding. Learners might think that square-ness has something to do with position on the page, colour, shading, and so on. The provision of the non-examples on the right-hand side clearly shows that the only difference between squares and non-squares is shape.

FIGURE 10. Showing 'square-ness' by giving examples and non-examples



Examples must be …

Most of the time, examples should be chosen with the following criteria:

- They should be short.
- They should be clear-cut.
- They should be self-explanatory.

However, where you need to teach about the complexities or subtleties of particular situations, examples will need to be less well defined.