Activity R1
Introduction to electrical and electronic symbol: teacher, tutor and trainer notes

The purpose of this session is to help learners develop their knowledge and understanding of circuit symbols and components through a range of short, interactive learning activities. These are particularly useful to reinforce, or consolidate, existing learning. The activities are designed to:

- allow learners to work collaboratively in small groups, developing their knowledge through discussion as they work to complete the tasks
- promote thinking and reasoning skills by providing artefacts (cards) for learners to handle
- encourage high level thinking skills which promote deep learning.

Thinking skills approaches to teaching have been found to improve learning in many areas of the curriculum. These approaches emphasise processes of thinking and learning that can be applied in a range of contexts. Thinking skills in the National Curriculum[1] include information processing, reasoning, enquiry, creative thinking and evaluation.

Many problems cannot be solved in your head, so these activities introduce and develop some simple ‘thinking tools (card s), which help learners to think about conceptual ideas in a concrete way. They encourage peer interaction, discussion and reasoning, which are essential to effective thinking. They also give learners a structure in which they can think and record their thoughts systematically and to change their minds if necessary.

The session is presented in the context of electrical engineering using electrical symbols and components. This is only one of many possible contexts and the activities lend themselves to wide-ranging adaptations.

[1] Department for Education and Skills: The Standards Site www.standards.dfes.gov.uk/thinkingskills/

For example, the cards and worksheets can easily be adapted for use in hydraulics or pneumatics circuits or motor vehicle circuits and components. Even the electrical circuit context presented could be refined to focus on either analogue or digital electronics.

Learning objectives

Learners should be able to:

- name an electronic component from its circuit symbol
- recognise the function of the component
- match the circuit symbol to the physical component
- develop reasoning and evaluative skills.

Materials required

For each group of learners you will need:

- two sheets of flip chart paper
- a marker pen
- Card set A (yellow) – *Circuit cards* (name and function)
- Card set B (blue) – *Circuit symbols*.

The card sets are available in activity box 3 of the NTLCP Engineering resource.

For each learner you will need:

- copies of Worksheets 1, 2 and 3 and an answer sheet for the name and function activity
- example session plan from CD-ROM *Resources*.

Time needed

About 2 hours.

Starting points

This is a revision activity and you might use it at the end of the relevant module. The first part of the session aims to help learners recall the circuit symbols they have met previously. This is to establish prior knowledge and will help learners to put their new learning into a context. Effective learning only takes place when learners 'construct' meaning for themselves and make links between old and new knowledge and understanding. These links can only be created by learners and are best achieved by using active learning approaches. This first activity will also allow you to establish your learners'

starting points and help you plan to differentiate your session.

Suggested approach

The session is organised in two parts.

Organise the learners into pairs. You may want to plan who works with whom, or you may be content for random pairs to form. Ask the pairs to draw on their mini-whiteboards as many circuit symbols as they can remember in a few minutes. They might choose to draw them or name them.

Then join two pairs together to form groups of four. Each group of four should be provided with a sheet of flip chart paper to produce a poster showing their combined set of circuit symbols.

Ask each group of four in turn to display their poster on the wall and to name the symbols they have drawn. Ask other groups if they agree and explore any differences or misunderstandings through whole class discussion.

To end, ask each group to add any additional symbols to their flip chart. In this way learners can learn from each other.

As the groups work, observe and listen to the discussion. This will help you monitor the extent of each learner's understanding and give you a feel for which learners have a good grasp of circuit symbols from previous learning.

By this point you will have enough information to help you decide:

- how to organise learners into groups
- whether you should ask less confident learners to work initially with fewer cards, adding in more, or more complex, components and symbols when they have gained confidence
- whether you should ask more advanced learners to work with all, or more complex, components and symbols
- whether you need to offer different learners adapted worksheets.

Developing the session

For the second part of the session, organise learners into new groups of up to three. To make sure that everyone is actively involved, groups need to be small; in groups larger

than three, some learners become ‘passengers’ and are not engaged.

Ask each group to head a flip chart page with four columns: ‘meters’, ‘power supplies’, ‘transducers’ and ‘other components’.

Use question and answer to run a whole class discussion drawing out the meaning of the terms ‘meters’, ‘power supplies’, ‘transducers’ and ‘other components’. Ask for one or two examples from the flip charts. Ask other learners if they agree or disagree, or want to challenge or expand points. Promote learning through use of learner explanation rather than addressing the points yourself.

Name and function activity

Give each group Card set A (yellow, name and function) and ask them to shuffle them. The activity requires learners to sort and classify the components into four groups. Ask them to:

- place the cards face down on the table
- take turns to pick a card from the top of the pack and read it out.

The group should discuss and agree into which column of the flip chart it should be classified. If the group cannot place a card it should be returned to the bottom of the pack and another taken from the top.

As group work progresses, you should:

- move between the groups listening to the learners
- identify misconceptions
- explore misconceptions by asking open questions
- avoid the tendency to close down discussion by providing the correct answer
- ensure learners remain focused on the task by reminding them of the objectives and the time remaining
- ensure all learners contribute to the group.

If there are cards left that learners cannot classify, you may need to prompt in more detail with questions and answers.

Ask groups to walk round checking each others’ classifications until they are all in agreement and think they have found the correct solution. Then distribute answer

sheets for a final check. If there are still misconceptions ask successful groups to explain their reasoning to others.

Circuit symbol activity

Now ask groups to relate the names of components with their symbolic representation. Distribute Card set B (blue, circuit symbols) to each group. Ask learners to:

- share out the blue circuit symbol cards between the group members
- take it in turns to show and discuss each symbol card and then pair it up with the correct name and function card.

When all the cards have been arranged on the flip chart, ask learners to view each other's pairings and discuss any differences.

You should monitor the group discussions as before. If you are thorough in doing this and explore any misunderstandings as they arise with questions and answers, you should find that the groups reach the correct solution independently and this empowers learners.

However, if learners are in any doubt about the identity of any symbols, this is a good point at which to refer them to a reference source such as BS3939 or a similar text. This will increase confidence in using their support material.

Consolidating and checking learning

Worksheet activity: creating a permanent record of your work

Distribute copies of three worksheets to learners:

- Worksheet 1 – *Components*
- Worksheet 2 – *Transducers*
- Worksheet 3 – *Power supplies and meters*.

Ask learners to complete the blank boxes on the worksheets. When they have finished, ask them to exchange their completed worksheets with a partner to check their answers. If necessary, use questions and answers to help them to work it out for themselves.

Additional suggestions

- This is a good opportunity for differentiation by modifying the worksheets to contain more or less blank boxes. (Download from CD-ROM *Resources*.)
- You could ask learners to record their work in different ways, for example by using a digital camera to capture the card classifications, or by encouraging learners to use their own mobile phone cameras. The photographs could be printed or placed on an intranet.

'Find the component' activity

This would be a good time for a 'find the component' exercise to reinforce understanding. Provide a box of assorted components and ask learners, working in pairs, to find a component and to place it on the appropriate card circuit symbol.

Alternatively, if you are working in a workshop or laboratory, encourage learners to find out where the equipment is stored by selecting components from the store and matching them with their symbol.

It is good practice to ensure that you leave sufficient time for learners to replace the equipment tidily in the correct storage before the end of the session.

You might decide to use this hands-on activity earlier in the session to enable learners to identify the symbols and relate them to the components more meaningfully. This practical and visual reinforcement could help them to recall the symbols more reliably.

What learners might do next

When they have successfully completed the tasks above, learners might investigate a selection of circuit diagrams to find symbols not on their worksheets, for example transistor, op amp, relay. They should identify any unknown symbols, possibly using a computer with an Internet connection or using suppliers' catalogues.

Many providers receive suppliers' component catalogues on CD and these could be saved and used to develop an extension activity. Learners could be directed to the Learning Resource Centre (or equivalent) where a member of staff could distribute the CDs, logging that the learner has been to collect one. This is a useful way to help learners recognise the links between teaching, learning, independent study, Information technology and the Learning Resource Centre.