How a Computer Works/Low-Level Programming

Trainer Notes

# Resources needed

Handouts for the “How a Computer Works” activity  
Flip chart paper and pens  
Computers (able to run a Java applet) with internet access  
Old computers to take apart or some bits  
Projector

# Room layout and practical elements

Tables away from computers in the morning – suitable for group work  
Computers for the afternoon – suitable for pair work  
Coffee/tea for 11am and 2.30  
Lunch break at 12.45

The day is structured with an intense morning with a slightly more relaxed schedule in the afternoon with time for reflection.

# Session 1 (9:45 – 11:15)

Start off with introductions – of trainer(s) and ask all teachers to introduce themselves and say something about their school and where they are with Computing. You also want some indication about how much they know about Computing already as this will help you pair people up so that they can support each other.

## Slide 2: Objectives

It is important that the objectives of the session are clear and what will be covered. We want to evaluate the sessions and it is important that teachers are aware of what the objectives are when they review whether they learned enough from the session. Sometimes they may have some misconceptions about what the goals of the sessions actually are. This slide is shown at the end of the day as well to help guide teachers with their reflections on the session.

The areas covered in the TA Matrix of Range and Content are: **C1, C2, C11, C12, P16**

See <http://www.computingatschool.org.uk/data/uploads/CSSubjectKnowledgeRequirements.pdf> for more information

Slide 3: Agenda

Slide 4: What is a computer (Starter Activity) – 15 minutes max

This is a warm-up activity. Ask teachers in groups of 3 or 4 to decide a good definition of a computer and write it down in large writing on a piece of flip chart paper. Give them 5 minutes to do this and then give them some blu-tack to stick it to the wall.

You can then review the flip-charts by walking round and reading off the flip charts to the group. This is generally a faster way of reviewing the activity than asking each group to stand up and present their answer.

Slide 5: Answers! Put up the definitions and discuss whether they are in line with what the participants thought. Highlight that these answers refer to different aspects of what a computer is.

## Slide 6: Activity (30 minutes)

At this point it would be good to have a practical activity whereby teachers can take apart a computer and discuss on tables what the components are and how they work. Aim to have mixed ability tables (this can be sorted out during the introductions) so that there are some teachers that can share what they know with others. This exercise takes away the magic of the computer when the processor is seen as a piece of hardware like any other. Offer brief answers to questions raised by teachers.

## Slide 7: Role Play Activity (30 minutes) – How a computer works

Divide the group into groups of three and follow the instructions in the pack. The teacher notes begin as follows:

The purpose of this activity is to give the students a basic sense of how computers

work by having them act out a simple computer simulation.

Each student takes on the role of a different part of a simplified computer and they

work in groups to run a simple program. The end result of this program is to draw a

picture on a simulated computer display. It is designed for groups of 3 students…

COFFEE BREAK

# Session 2 (11:30 – 12:45)

## Slides 9 – 12 (15 minutes) – short presentation

Talk through the components of the processor and introduce the idea of executing instructons being in a cycle. Refer back to the exercises and activities done in the first session to relate to practical experience.

Allow time for questions and answers.

## Slides 13- 24 – Introduction to Little Man Computer (20 mins)

Little Man Computer has become used in schools since it appeared in one of the OCR GCSE Computing Controlled Assessment Activities.

Give some background of the Little Man Computer Simulation (see <http://en.wikipedia.org/wiki/Little_man_computer> for some general background and links to more information) – it was originally described by Stuart Madnick in 1965 to describe the way a computer works in a simplified way.

The first 6 slides give an overview of the Fetch Execute Cycle:

**Fetch** instructions being collected either from memory

**Execute** After the correct instructions have been fetched the CPU will then interpret what the instruction is telling it to do then it will simply execute the instruction and the whole process will begin again

**Repeat** the whole process will begin again

There is a nice YouTube video here: <http://www.youtube.com/watch?v=G7Rhwv_J3eQ> made by Richard Neville of the University of Manchester which might be useful to watch also.

The next few slides describe some of the commands. You could skip these at this point (but make them available to the teachers either printed out or on a shared area) as these will make more sense when they have tried out an LMC simulator for themselves.

## Slide 25: Starting to use the Little Man Computer Simulator

There are several versions available. These session notes use the Riven Applet which has an easy-to-use interface compared with some of the others.

If you decide to use another simulator, then edit the slides accordingly as the instruction sets are all very slightly different.

The teachers should then start up the applet and you may want to get them to do this IN PAIRS

## Slide 26/Slide 27: Practical experience of writing a program

The teachers should try out the first simple program and make sure they can get this working. IF they have no problems with this ask them to experiment with different programs and commands while you help others.

LUNCH BREAK

*are no more instructions or the computer is turned off.*

# Session 3 (1:30 to 2:30) - practical

## Slides 29-36 Exercises using the LMC (45 minutes)

Most teachers work productively in pairs and this is a good model demonstrating how students work well. Working in pairs stimulates the most discussion and effective trouble-shootig.

There are a series of exercises. Ask the teachers to work through them. Go over the answers after around 35 minutes or so.

## Slide 37: Discussion

As a trainer you may not have the teaching background so this is the time when you ask the teachers to reflect how what they have learned in the last two sessions translates to the classroom. Ask for practical ideas about how this could be introduced in the classroom. What difficulties would they imagine that students would have with the material? What would be good homework exercises around this topic. Is working in pairs a good approach for the classroom?

Coffee/Tea break

# Session 4 (2:45 – 4:00)

## Slides 39-42 (45 minutes)

In this session the differences between high level and low-level programming languages can be explored. There are two exercises to do. This assumes that some of the participants will have some programming experience in any language. Get them to work in pairs on the two exercises.

Finish this session with a discussion of the difference between high-level and low-level languages which you could expand on if there is the appetite within the group.

Slide 43 – recap learning objectives (5 minutes)

Allow a good fifteen minutes at the end of the session to explore what the teachers have learned and take feedback. Go over the original objectives of the session to help teachers reflect on what they have learned and start to identify next steps. Emphasise a) that this is the beginning of understanding computer hardware and it may be useful to follow up with a longer course over a period of time. Ask teachers to identify what other areas of theory they feel they need to cover.

Slide 44 – complete feedback forms (5 minutes)

The feedback forms are stored here: <http://surveymonkey.com/s/NoEFeedback> . Teachers should fill this in in order to receive their certificate for the course. The NOE will share the feedback with you as soon as it is collected.

Slide 45 – final reflections (5 minutes)

Ask teachers to share with each other what they will do as a result of this course. Encourage them to stay in touch with each other and provide a means for them to share their email addresses. Actually making a commitment to do something is the first step – otherwise the value of the training can be quickly lost.

Finish at 4pm