

USING ICT AND WEB-BASED MATERIALS FOR LEARNING & TEACHING AND DATA HANDLING ACROSS THE CURRICULUM IN SCHOOLS

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A common concern in the professional development of teachers is to provide them with appropriate technical support and training in the use of information and communication technology (ICT). The need for such training is a current concern in, amongst other places, the UK and the Northern Territory of Australia, and this has provided the first motivation for the development of an appropriate training course emphasizing ICT tools such as the web, email and MSTM Excel. The second motivation is through a desire to help the development of teaching data handling in schools. Consequently, the Royal Statistical Society (RSS) Centre for Statistical Education, UK, together with Dr Ian Roberts of Northern Territory University, Australia, developed an ICT-type training course that is centred on data provided by the UK-based CensusAtSchool project (<http://www.censusatschool.ntu.ac.uk>).

INTRODUCTION

The training course described here is designed for the professional development of teachers of students aged 7 – 18. It teaches the use of basic computer-based tools, such as word processing, using spreadsheets and the web, and integrates them so that existing or new web-and/or paper-based teaching and learning resources can be developed for the benefit of students. Also it uniquely wraps the ICT training around data handling specifications across many subjects. The teachers benefit from significant hands-on experience with each of these tools, and they use their own specialist curriculum knowledge to begin to develop web-based teaching resources specific to their disciplines. This is achieved by using the real data from the *CensusAtSchool* project (www.censusatschool.ntu.ac.uk) as the substantive content of the development.

Specifically, the aims of the course are:

- The professional and personal development of teachers;
- To get teachers to appreciate that using real data is a powerful motivator for learning;
- To give teachers an opportunity to participate in a national and international activity, the *CensusAtSchool* project;
- That teachers will appreciate the need to collect data using samples or censuses, in order to make informed decisions;
- To enable teachers to construct ICT-based and traditional learning and teaching material;
- To provide methods to improve the classroom and home-based statistics education of students in schools.

The five learning outcomes for the training course are:

1. An ability to use confidently information technology methods for learning and teaching;
2. An ability to locate and retrieve appropriate web resources and material;
3. An ability to develop ICT-based resources;
4. Knowledge of the basic principles of data handling in an ICT context;
5. The principles of, and reasons for, using samples and censuses.

The training course is based upon a two-stage approach to learning. Stage 1 comprises a face-to-face interactive training course, while stage 2 is based upon home-based work that is spread over several weeks and involves self-learning and self-paced activities in this period. In stage 1 there are 13 training sessions accompanied by full and detailed notes that are used as an

integral part of the training. Each trainee will be expected to have achieved the above five learning outcomes at the end of this stage.

During the weeks after receiving the training in stage 1, the teachers are expected to create material and activities from electronic and other sources that are subject-specific and can be used in classes with students. This activity, which may well be home-based, will bring further learning benefits for the trainees. In particular, after this second stage, the further learning outcomes will be:

- Information technology-based resources that can be used to enhance and reinforce students' knowledge;
- Methods that can be used for the creation of further worksheets for use by students;
- ICT knowledge and techniques so that teachers can take a lead in the use of technology in their schools.

Some of the supplied notes are designed to be reference material and helpful for use over the development period. The materials that the teachers produce are, at the very least, shared among themselves. As an added incentive the teachers are encouraged to submit the worksheets to the RSS Centre for Statistical Education for scrutiny and these may be added to a web-based resource for all teachers who take part in the training. They are also added, as appropriate, to the international resource available through the RSS Centre for Statistical Education *CensusAtSchool* web site.

MOTIVATION

Key motivating and underpinning factors for creating this training course are data handling, coupled with the use of ICT methods for learning and teaching. A rich source of accessible data has been collected during the running of the UK-based *CensusAtSchool* project. See, for example, Connor and Davies (in press). These data are freely accessible for sampling using web-browser techniques. How this can be done, including tips about creating realistic project scenarios, is described by Connor, Davies and Payne (in press).

Data handling is a topic that is common to many core curriculum subjects taught to students throughout schools across the world. For example, in England, throughout the mathematics curriculum the clear message is that data handling is best taught in the context of real statistical enquiries, in a coherent way so that teaching objectives arise naturally from the cycle, as represented in the Figure 1.

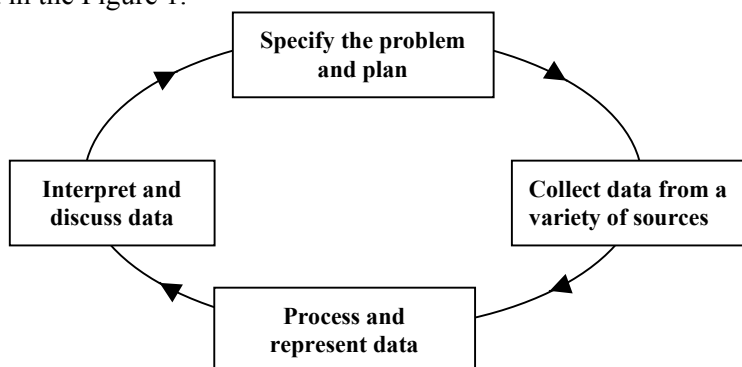


Figure 1. Teaching Objectives Arise from the Cycle.

Other subjects within the English national curriculum have similar descriptions for the role of data handling within their subject-specific contexts. These subjects include Science, ICT, History, Geography, Citizenship and Key Skills.

The new English Mathematics curriculum for 15 and 16 year old students, for first examination in 2003, in addition to the overall data handling picture presented above, requires candidates to produce one piece of extended work that demonstrates an ability to handle and compare data. This is worth 10% of the total marks. This data handling project also offers opportunities for candidates to produce a piece of work that will satisfy the vast majority of requirements for Key Skills in both Application of Number and Information Technology

(provided ICT methods are utilised) at level 1 or 2 and indeed much of level 3 of Application of Number.

Many worksheets that use the *CensusAtSchool* data are freely downloadable from the web site www.censusatschool.ntu.ac.uk/resources. Ways in which samples from the database, which contains over 60,000 records, can be used by teachers to craft their own worksheets are described in detail by Connor and Holmes (in press). Thus, the data stored in the database, coupled with the potential for the innovative use of ICT resources to design, write and use classroom worksheets for students were key motivating factors that led us to design this training course.

NEEDS ANALYSIS

Before running the course a comprehensive needs analysis is carried out by inviting all participants to complete a questionnaire covering their knowledge of:

- Microsoft Word, including formatting and drawing, text, document and picture handling;
- Internet Explorer, including searching, the use of Internet tools and creating Word documents from Internet resources;
- Excel, including the use of bars, buttons, icons, text and number handling, shortcuts and entering data using the Data Form.

A key outcome of the course is the use and integration of all these electronic tools and resources and we regard it as crucial to take account of the baseline knowledge of the participating teachers. The results of the needs analysis are reported to the teachers before the course starts so that they are aware of the assumptions being made.

COURSE CONTENT

The course comprises four main sessions listed as follows:

1. Using Computers and the Internet;
2. Data collection, cleaning and summarising;
3. Creating Resources;
4. Bringing it altogether.

Each session lasts between 2½ and 3 hours and so can fit into morning/afternoon periods of delivery. Each of these is delivered interactively, using a range of teaching and participant-centred activities, such as the use of flip charts for teacher discussion and brain-storming, the collection of simple measured data from each teacher, computer intensive periods, for example the use of Excel in a *shared workbook* to store the teacher data over a network, and the use of Excel to display those data. The main sessions are divided into three or four sections. For example, the second main session is divided into three sub-sessions as displayed in Table 1.

Table 1

Second Main Session Divided into Three Sub-Sessions

2 Data collection, cleaning and summarising
2.1 Principles of collecting data: the role of a classroom-based census, questionnaires, data collection and using a spreadsheet to summarise and present data.
2.2 The dirty data worksheet: cleaning data by visual inspection and the use of a spreadsheet to carry out similar activities.
2.3 Data analysis using the Census Handling in Microsoft Excel (CHIME) document.

Tables 2 to 5 list the interactive activities that are carried out in sub-session 2.1 of Table 1. Each teacher is encouraged to think about the creation of pupil-centred worksheets as they go through each activity.

Table 2

Activity 1

Activity 1

Write down what you think *statistics* is and what *data handling* means to you. And what do these terms mean to your pupils?

Table 3

Activity 2

Activity 2

Using the tape, measure the length of your right index finger and the circumference of your right wrist. Make a note of these measurements by entering them in the following table.

Name:

Gender

Primary/

Secondary

School

Length of right index finger

Circumference of right wrist

Height (already collected)

Length of right foot (already collected)

Open the *shared* Excel spreadsheet *teachers.xls* on Y: drive. You will notice that your data on height and right foot are already there. Now add *your* data on length of right finger and circumference of wrist to the cells *next to your name* in the Excel spreadsheet. Click *File>Save>File>Close*.

Please do not enter data into another person's cell areas, as that will cause a clash!

Table 4

Activity 3

Activity 3


The *CensusAtSchool* questionnaires for phases 1 and 2 have, amongst others, questions about:

Gender, age, date of birth, height, colour of eyes, preferred school subjects, jobs done at home, size of classroom, whether or not you had breakfast, what you had for breakfast if you did have it.

Specify the type of measurement scale, namely categorical, ordinal, measured/ratio, or ratio, for each of the data responses to these questions.

In activity 2, the teachers measure and collect data about themselves and use the worksheet *share* facilities within Excel to store their personal data in a common spreadsheet over a network. Activity 4 is designed to consolidate activity 2 by getting the teachers to use simple data handling functions within Excel, together with rudimentary plotting facilities, on their own data. It also emphasises the important need to *interpret* data and graphs in order to gain information from them.

Table 5
Activity 4

<p>Activity 4</p> <p>Open the (now) <i>unshared</i> Excel spreadsheet <i>teachers.xls</i> on Y: drive and answer the following questions.</p> <p>1 Are the males on <i>this training course</i> taller than females? To find this out:</p> <ul style="list-style-type: none"> • In cell <i>E8</i> type <code>=AVERAGE(E5:E7)</code> and tap return • In cell <i>M16</i> type <code>=AVERAGE(M5:M15)</code> and tap return <p>Write your conclusions here</p> <p>2 Obtain the average lengths of the <i>right foot</i> for male and female teachers. Use similar commands to those in 1 above to obtain the appropriate averages. Make a note of the average length of right foot and height for males here....</p> <p>3 To draw a scatter plot of length of right foot against height highlight the cells <i>E17</i> and <i>F17</i> to <i>E31</i> and <i>F31</i>. Click on  (<i>Chart Wizard</i>) > <i>XY (Scatter)</i> > <i>Finish</i>. Describe the scatter graph in 3 sentences.</p> <p>4 Repeat exercise 3 by drawing the scatter plot of height against circumference of right wrist.</p> <p>5 <i>Printing tip:</i> To print the spreadsheet on <i>one</i> page of A4 (the default print would occupy two pages of A4) click on <i>File>Page Setup...</i> > then click on the radio button to the left of <i>Fit to</i> and Click <i>OK</i>. This will adjust font size and layout so that <i>File>Print...</i> and then <i>OK</i> will produce the desired single page.</p>

SUPPLEMENTARY MATERIAL - CHIME

The document by Hunt and Tyrrell (2001), *Census Handling in Microsoft Excel*, provides key background material for both stages of the training course. It is also a useful stand-alone manual for those who need careful guidance into many of the key tools needed for the successful use of Excel in teaching and learning. For example, CHIME contains many innovative uses of pivot tables but also starts from scratch for those with little or no knowledge of the intricacies of a spreadsheet as a medium for learning and teaching data handling. It is a very easy document to dip into.

As shown in Table 1, sub-session 2.3 is devoted to following relevant sections in the CHIME handout. However, the document is designed for self-paced learning as well, and contains a very rich source of activities that could be easily carried out in home-based study. In fact, the second stage of the course can require the use of CHIME, as well as the detailed notes provided.

CONCLUSIONS

The first trainee teachers for the course comprised four that teach in UK secondary schools, and 10 who teach in primary/junior schools. The pilot course was run in the Cwrt Rawlin Primary School, a brand new school in South Wales. It provided an ideal environment, where a dedicated ICT room with full Internet access and excellent other learning and teaching facilities were made available. Each teacher trainee was asked to complete a post-stage 1 questionnaire about every sub-session and also the extent to which they felt that the aims and learning outcomes of the course had been met. Trainees were also invited to comment on how each sub-session could be improved. We have been very encouraged by the responses we have received from the first cohort of teachers that have received the ICT and data handling training course. The first group of teachers who participated made a number of useful suggestions and these have been incorporated into an amended set of notes. The teacher-created resources will be added, subject to appropriate scrutiny, to the existing library of freely available curriculum-based resources available from the *CensusAtSchool* website. This area is called *Teachers' Notes and Ideas*.

We would welcome all teachers interested in helping to deliver this training course, in any country in the world, to make contact with the first named author. The international nature of the database we are creating makes it possible to localise the data and subject material to suit different syllabuses and contexts. We plan to try to disseminate the course, subject to appropriate

scrutiny and standards set by the RSS Centre for Statistical Education, for the enhancement of the professional development of as many teachers as possible, and data handling and ICT skills for as many students as possible.

REFERENCES

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