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# Teaching Science Online

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## Introduction

In this paper I describe an online approach to teaching a General National Vocational Qualification (GNVQ) science course using digital materials produced by 3E's Multimedia delivered via the Digitalbrain platform. When I first came across this approach to teaching science I realised that it was likely to make big changes to the way in which I teach.

All other 100 schools involved in piloting the 3E's Multimedia materials were given several days of training spread over four terms. Despite this, the first year in which the materials were used was a steep learning curve for me and for my pupils.

Each Digitalbrain user, both staff and pupils, is given their own web space. Once the user has logged onto the Digitalbrain website they are presented with their home page (figure 1). This contains a calendar for appointments and a series of links to various tools, and can be easily customised by the user. The other tools available include the user's web space and Digitalbrain email; it is these that have proved to be most useful in delivering the GNVQ science course at my school.



Figure 1

## The Course


Without the Internet, the online GNVQ Science course materials could be used as a good interactive textbook, complete with Macromedia Flash animations to assist descriptions of scientific phenomena. In conjunction with a projector, the whole class can be led through a complex explanation that would be difficult to do with a text book or worksheet. However, with access to a broadband Internet connection, together with pupil access to computer rooms for at least two out of their five science lessons per week, I have radically changed the way I deliver the curriculum.

The first thing I disposed of was the exercise book. The pupils keep rough notes during experiments in the lab and write up their work into computer files. A lot of the preliminary work for experiments is done using the science content from 3E's Multimedia, e.g. figure 2, which shows the top level choice for Unit 1 of the course. When the pupil has chosen


either chemistry, biology or physics they are then presented with a further set of choices until they home in on the specific procedure they intend to carry out. From this page the pupils can choose the experiment they are going to do and think about the best way to carry out the procedure.

What you need to learn


- Standard Scientific Procedures
- Applying Practical Skills in Chemistry

 Practical Skills  
**CHEMISTRY**

- Applying Practical Skills in Physics

 Practical Skills  
**PHYSICS**

- Applying Practical Skills in Biology

 Practical Skills  
**BIOLOGY**

- Assessment Evidence

UNIT 1 IS MANDATORY, ASSESSED BY PORTFOLIO. You need to produce a portfolio in which you have recorded at... [more]






 list  edit  my notes  make a note  add link

Figure 2

Figure 3 shows the pupils what to do when testing a chemical sample for hydrogen carbonate ions. The photographs from the sequence can be copied by clicking on the Word icon next to the text. The Acrobat icon is for fast downloads on a slow system (figure 4a to c).

ACTIVITY 1.1a Chemical Tests for Anions

3



**HYDROGEN CARBONATE IONS**

If the gas produced turns **limewater "milky"**, carbonate,  $\text{CO}_3^{2-}$ , or hydrogen carbonate ions,  $\text{HCO}_3^-$ , are present in the sample.

    SELECT ANION

**Links:**

- Portfolio Evidence - Word Format (.doc)
- Portfolio Evidence - Acrobat Format (.pdf)

 list  edit  my notes  make a note  add link

email: user-support | webmaster | partnerships | © 2002 digitalbrain | company information | terms and conditions  
digitalbrain requires version 4.0 browsers with JavaScript enabled. Some areas are enhanced with Macromedia Flash

Figure 3



Figure 4a



Figure 4b



Figure 4c

Access to these electronic resources saves a lot of time copying unnecessary information into exercise books. Pupils can quickly download an experimental procedure and put it into a style that suits themselves. In converting the information into a form with which they are comfortable they retain the important elements of what they need to do in the lab.

Following the experiment the pupils write up their work which will go towards the portfolio of evidence they must collect for the unit they are studying. To assist them, a frame with hints and headings has been provided. To access the frame the pupils click on the “portfolio evidence – word format (.doc)”, as shown at the bottom of figure 3. In this particular case the frame appears as shown in figure 5.

Unit  
**1** Applying Practical Skills

Chemistry – Carrying out chemical tests to identify substances

**Portfolio Evidence – (Enter your name)**

**Activity 1.1a & 1.1b: Chemical analyses**

1. Introduction: Type of chemical analysis to be carried out
2. Safety points
3. Materials and methods
4. Results
5. Evaluation
6. Discussion of vocational implications

Figure 5

Not all the pupils choose to use this frame. I have written my own frames that give more guidance to those who need it; my version of the results and evaluation section for the activity shown in figure 5 is shown in figure 6.

Results for Ions Tests			
Ion	Type	Test	Result
Chloride (Cl <sup>-</sup> )	Anion	Add silver Nitrate Solution	
Sulphate (SO <sub>4</sub> <sup>2-</sup> )	Anion	Add acidified Barium Chloride solution	
Carbonate (CO <sub>3</sub> <sup>2-</sup> )	Anion	Add dilute acid and test gas with lime water	
Copper (Cu <sup>2+</sup> )	Cation	Add Sodium Hydroxide solution	
Iron	Cation	Add Sodium Hydroxide solution	

**Evaluation**

- Do qualitative tests tell you how much of a substance is present?
- If the test substance is a mixture will you get clear results?
- Will the tests work if the substance is insoluble?
- Is there an amount of substance needed to get a positive test?
- Can your test substances be contaminated?

A scientist was asked to identify four samples of unknown substances. The results of the analysis are in the table. Use the results of your experiment to identify each sample (both the metal cation and the anion it is bonded with).

Test	Sample A	Sample B	Sample C	Sample D
Add silver Nitrate solution	No	No	No	White ppt
Add acidified Barium Chloride solution	No	White ppt	White ppt	No
Add dil acid and bubble gas through lime water	Milky ppt	No	No	No
Add Sodium Hydroxide	No	Blue ppt	Brown ppt	No
Flame Colour	Red	Green	No	Yellow

Sample A =  
Sample B =  
Sample C =  
Sample D =

Figure 6

To see this frame pupils access my web space on the Digitalbrain site. This is where access to the Internet comes into its own.

## Electronic Homework and the Internet

The pupils do not just visit my web space to access the frames for portfolio work. There are also documents there to aid understanding, links to other sources of information and an area where they can post their completed work (figure 7).



Figure 7

The web space is made up of a series of online folders; the power of these lies in the way in which access to them can be controlled by the host user. For example the Admin and Lessons folders in figure 7 are accessible only by me, while Y10 pupils and Y11 pupils can access their respective folders only.

Inside the pupil folders are sub-folders that contain frames and other documents to help pupils understand the course content and to help them produce evidence for their portfolios. If pupils use a digital camera to record a novel set up or outcome from a procedure, I will post the images here for them to access. Sometimes the pupils ask if I will upload a piece of work or explanation of a scientific principle that we have done in the lab

so that they can make use of it. For example, Unit 5 of the course requires them to test sports shoes. Digital images of these shoes are posted in the Unit 5 folder before they begin to take the shoes apart (figure 8).



Figure 8



Figure 8a



Figure 8b

The Pupil Work folder contains individual folders for each pupil in the group. Access to a pupil's folder is restricted to that pupil and to me. When a piece of work is complete, the pupil has the option of showing me on screen if we are in a lesson, or they may upload it to their folder and then send me an email to tell me that they have done this. As long as the email is dated before the deadline for that piece of work, the pupil will avoid detention.

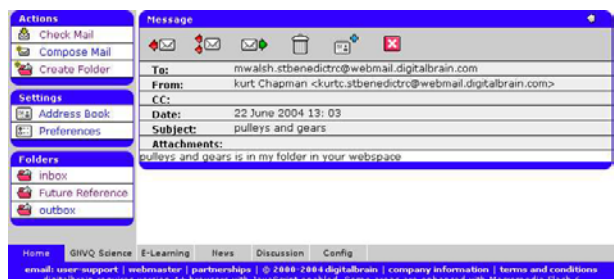
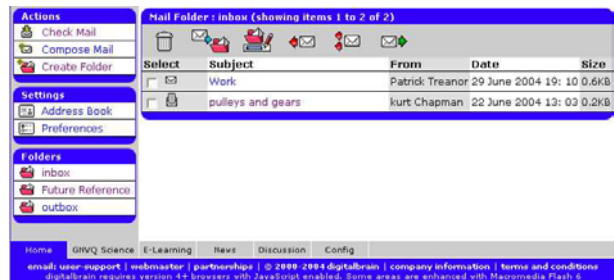


Figure 9

The power of this system allows pupils to keep up with work even if they cannot be in school for any reason. One pupil completed his work on a plane to Australia and posted it while on holiday; pupils think it is outrageous that they cannot escape the long arm of the coursework deadline!

When they have finished their work, pupils use the exam board criteria to mark their own work. Once again I have a folder to help them (figure 10).



Figure 10

Towards the end of year 11 (age 15 / 16) pupils have completed their coursework and spend time improving it so they can improve their grades. During this time I am constantly bombarded with emails asking if a piece of work is good enough to fulfil a particular merit or distinction criterion. I have even had one pupil, working in an ICT room some distance from the lab, who sent me an e-mail to ask if I would pop down and give him some help.

Most of the help files for marking were produced to reduce the amount of emails and to enable the pupils to progress with their work outside the school environment.

## Conclusion

Teaching this course has had a dramatic impact on the pupils and on me. Lessons are much more pupil orientated, and I move around the room answering questions about a variety of different aspects of science. The pupils who find learning difficult have more time to come to terms with the basic knowledge, while the more able explore new depths of knowledge, sometimes finding out things I knew little about. I don't think I have ever worked so hard during lesson time, as there is always another question about a different piece of work. However, when I do get the odd chance to look about the room I see pupils fully engaged on their studies and thinking about what they are doing.

One observation that has been made about more traditional approaches to teaching science is that the pupils produce a mini version of a text book in their exercise books and can be quite passive during the lesson; there is no way that my pupils are engaged in this kind of activity. The consequence of this is that more quality time is spent practising experimental skills or carrying out scientific investigations. This dramatically improves their understanding of science and their ability to carry out safe experimental procedures that produce reliable data. Another advantage that I have seen is that it is very easy to run mixed ability groups, with pupils accessing work at a level they can cope with. In addition to this, I have also been aware of a lot of peer learning as they ask each other for help almost as much as they ask me.

I am sorry to see the end of GNVQ in 2006 but I know that 3E's Multimedia are working on taking Internet Science into the new specifications at 14 – 16 using an extension to this GNVQ course called "Click Science". I intend to be as fully involved in this new initiative as I can, as I am certain that this is the way we should be teaching Science.

**Michael Walsh** is Science Curriculum Director, Head of Physics and Science Mentor for Initial Teacher training at St Benedict Catholic Secondary School and Performing Arts College, U.K. Mike has been involved in an EU initiative to increase the amount of creative learning in Science.

In all the schools in which he has taught he has had responsibility for introducing new technologies in the classroom; in the last ten years this has mainly centred on computers and the Internet.

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- 1 Digitalbrain PLC  
<http://www.digitalbrain.com/digitalbrain/corporate/education/index.htm>
- 2 3E's Enterprises (Trading) Ltd  
<http://www.3es.com> and <http://www.3esmultimedia.com>  
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<http://www.3esmultimedia.com/science>