

## **A study of how of the Internet can be effectively integrated into lessons**

**Researchers:** Pam Wadsworth and Scott Preston

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**Contact Details:** Sharnbrook Upper School  
Odell Road  
Sharnbrook  
Bedfordshire, MK44 1JX  
Tel. 01234 782211  
Fax 01234 782431  
E-mail: [information@sharnbrook.beds.sch.uk](mailto:information@sharnbrook.beds.sch.uk)

**Research Topic:** Technology-integrated pedagogical strategies:  
Secondary Science Teaching and Learning

**Geographical Area where Research Conducted:** England – Eastern Region

**Educational Sector of Participants:** Secondary

### **Abstract:**

This small-scale case study examined how the Internet can be most effectively used within lessons, predominantly science, at secondary school level. The potential value of the Internet is well recognised with significant proportions of school budgets being allocated to develop ICT facilities. Along with this expenditure comes the expectation that this emerging technology will be integrated into lessons. However there is limited guidance offered to practicing teachers to assist in planning and structuring lessons to make effective use of the Internet as a teaching resource.

Year nine science lessons, developed for the new Key Stage Three National Curriculum, were the initial focus. The research concentrated on observation of the key elements of a good lesson, specifically planning (including consideration of lesson structure and resource development), classroom management and solutions to common technological problems. Questionnaires were completed by staff and randomly selected students to analyse current practice and use of the Internet. Individuals were interviewed to gain a more detailed picture. The data suggests that 'successful' integration of the Internet involves well-planned and clearly structured lessons, efficient searching and well-defined objectives. The findings of the study were compiled into a Good Practice Guide and circulated amongst staff.

### **Findings:**

- *Current usage of the Internet:*  
77% of the students surveyed described using the Internet as being generally worthwhile. 89% of the students and 84% of staff have access to the Internet at home.

Currently, the Internet is used in all curriculum areas, but in particular Science, English and Modern Languages. Sixth form students use the Internet more widely, both at school and at home. In discussion with students and staff, it was clear that a lack of confidence was a major factor in limiting its use. Use at home was also limited by financial considerations, irrespective of user confidence. Students found using the Internet in lessons a novelty and the majority of comments received were positive, but one student was honest to suggest that this was a good way to waste time in lessons!

- *Lesson Structure:*

Observations and discussions with staff revealed that (not surprisingly) effective Internet lessons are no different to any other well-constructed lesson. They should include a variety of activities, focusing where possible on the different learning styles in the class. Detailed planning is essential, and visiting the web sites in advance is of paramount importance. Some of the best lessons observed utilised a non-computer related “hook”, to engage the students and also allowed time for ground rules to be set. Structured worksheets were often strategically used as a means of guiding the students, allowing the teacher to take more of an advisory role in the classroom. The most successful lessons had a clear product, such as a poster or presentation.

- *Need for Guidance:*

57% of the staff used the Internet for their own interest, while 63% used it as a tool for student research in the classroom. However, only 45% of staff used the Internet for lesson preparation. The discrepancy between the latter figures would suggest that staff need guidance in using the Internet effectively. Throughout discussions, and indeed at the BSIP<sup>1</sup> conference, staff welcomed suggestions on how to maximise the effectiveness of Internet use, and led us to produce a “good practice” leaflet for staff. Please refer to appendix 1.

#### Participants’ Information:

The primary focus was year nine Science lessons. Information was gathered from three specific lessons, written within the department for the new Key Stage Three National Curriculum. These lessons, on Space and Satellites, Cloning and Global Warming, were delivered to all Science groups. These are broadly banded into upper and lower ability, but are considered to be mixed ability classes, with an average groups size of 27 students.

Other lessons observed included:

- *Year 10:*
  - Five Science sets: One higher ability set (group size 30), two middle ability sets (average group size of 26 students) and two lower ability sets (average group size of 20 students).
  - Four mixed ability ICT groups, with an average class size of 24 students.
- *Year 11:*
  - Four Science sets: One higher ability set (group size 29), one middle ability set (group size of 26 students) and two lower ability sets (average group size of 16 students).
  - One higher ability Mathematics set, with 32 students.

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<sup>1</sup> BSIP: Bedfordshire Schools Improvement Project

- *Year 12:*
  - One AS Level Biology group, with 18 students.
  - One GNVQ Land and Environment group (Foundation and Intermediate), with 4 students.
- *Year 13:*
  - Two A Level Physics groups, one of 9 students and one of 16 students.
  - One A Level Human Biology group, with 7 students.

All lessons were one hour in duration, except one year 12 Biology group, which was a double lesson.

#### Equipment and Materials used:

Lessons were predominantly observed in the Science computer base, which houses 12 networked PCs, with filtered Internet access. Larger computer suites were also utilised when appropriate, e.g. with large groups, when one computer per student was essential or when the Science computer room was already booked. All suites also have access to printing facilities, although students are allocated a limited print quota via use of the School's print auditing software, Pcounter.

Details of the year nine Science lesson plans can be found in Appendix 4.

The topics observed in year 10 lessons included "The History of Radioactivity", "Drugs and your Body", and "Searching for Clip-art" in the ICT lessons.

Year 11 topics included "Radioactivity and Half Life", "DNA and Inheritance" and in Mathematics "A Revision of Geometry".

The year 12 Biology lesson was entitled "Biomes – A Virtual Tour", and the GNVQ group used the MAFF website to obtain detailed, up-to-date information about "The Foot and Mouth Crisis".

Year 13 Physics students studied "Einstein's Photoelectric Effect", while Human Biologists researched "Food Poisoning and Pathogens".

The sites used fell into three categories:

- a. Informative, e.g. <http://www.epa.gov/airmarkets/acidrain/index.html> and [www.howstuffworks.com](http://www.howstuffworks.com)
- b. Interactive, e.g. <http://library.thinkquest.org/24355/data/createnav.html> and <http://www.mcasco.com/plaso.html>
- c. Regularly updated current affairs, e.g. [www.maff.gov.uk](http://www.maff.gov.uk)

#### Recommendations:

- *Staff Training:*

ICT training for staff should be a priority. Our evidence clearly suggests that effectiveness in the use of the Internet increases with practice. A particular area of weakness, in staff and students, is the ability to refine searches when using the Internet to research a topic. This is an area in which some initial guidance, followed by an opportunity to practise at a user's own pace, can produce

significant gains. Only when staff are confident in their own ability to use the Internet effectively will we see improvements in its use in the classroom.

- *Sharing Good Practice:*

Staff should be given opportunities to work collaboratively in the production of lesson plans. The World Wide Web, itself, is the ideal vehicle for sharing good practice. However, in the course of this case study, we found few sites that we considered worthwhile in this respect, and these were difficult to find. Sites such as Becta's "Teacher Resource Exchange" (<http://contribute.ngfl.gov.uk/>) should be the way forward, but as yet this is still in its infancy.

- *Lesson Preparation:*

The best lessons observed throughout this case study were, without doubt, very well planned. On average, a lesson lasting an hour took at least an equal amount of time to plan. The main time consuming factor was the research – finding appropriate website(s) to use and then constructing a lesson structure around the sites found. Even when acting on advice from colleagues and professional associations, staff found that the only way to ensure that the lesson went smoothly was to spend a good amount of time using the sites. Despite the amount of time taken to plan a "good" lesson using the Internet, all staff felt that it was time well spent. Above all else, though, it is important to remember that the Internet is another tool to use in the classroom. Use it when it is the best tool to use, and not just for the sake of using it!

Specific recommendations include:

- Ensure lesson objectives are clear.
- Keep an annotated record of possible sites.
- A good web site will have all the required information within 3 clicks of the mouse (limited hyperlinks).
- Build in differentiation – different web pages, structure of questions, nature of tasks etc.
- Consideration of lesson structure. The teacher must be in control of student surfing. We suggest you that prescribe the activity and specific URL or use a structured worksheet.
- Do pay attention to the grouping of students and the number of computers available.
- The lesson must have a product e.g. poster, free writing, presentation etc.
- Evidence suggests that the best lessons have a clearly prescribed activity and specific URLs. This may be achieved by using a structured worksheet or by discussing the task with the class.
- If a worksheet is not being used, limit the number of websites to only one or two. A worksheet will allow more flexibility if many sites need to be accessed.
- Ensure that clear instructions are given to students about the site(s) they to visit and the information that they are to gather.

Applied method of analysis:

The case study employed multiple sources of evidence; the research methods were based largely on teacher observation and professional dialogue with colleagues. A basic research diary was used to jot down interesting comments and thoughts; this was a useful reminder as well as a record of activities connected with the project. Both staff and students completed baseline questionnaires. Students were interviewed

informally in small groups, this was considered to be preferable to individual interviews since students feel less intimidated and we were able to benefit from the free discussion. Researchers from the University of Cambridge provided an additional perspective and useful triangulation.

Observations were mainly conducted by SSP & PJW, although some colleagues in the Digital Technology IQEA<sup>2</sup> group were also involved. Researchers from University of Cambridge also carried out observations followed by interviews that provided opportunities for discussion.

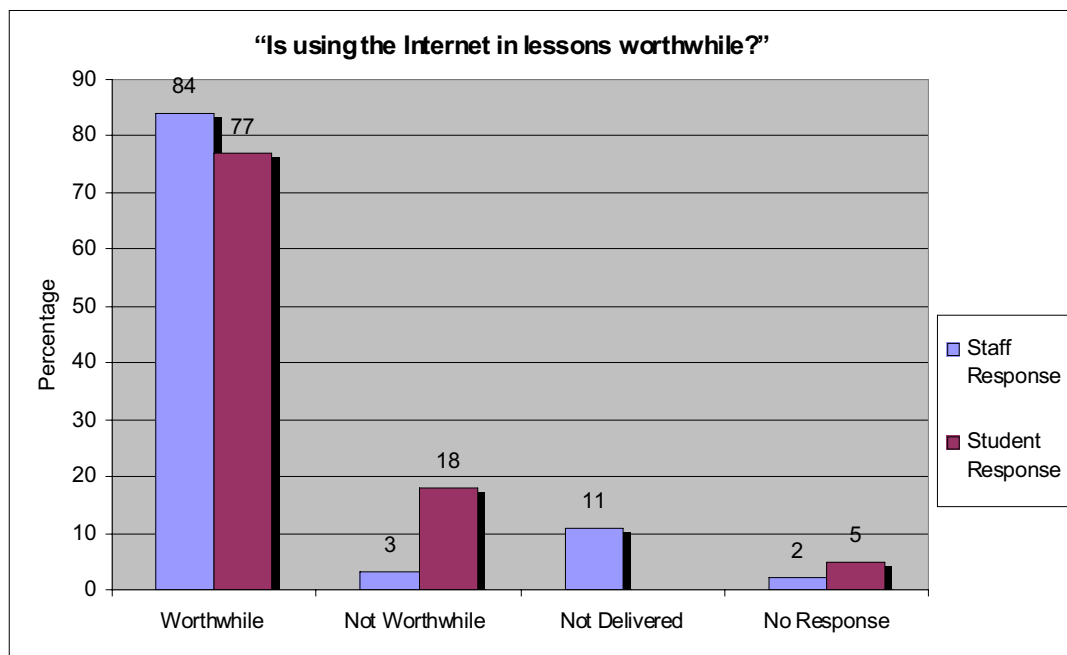
Sixty-one teaching staff completed base line questionnaires along with 178 randomly selected students, representing all years from nine to thirteen.

Interviews and discussions were held with five selected groups, each comprising four to six students:

- Two year nine Science groups.
- One year eleven Science group.
- One year twelve Biology group.
- One year thirteen Physics group.

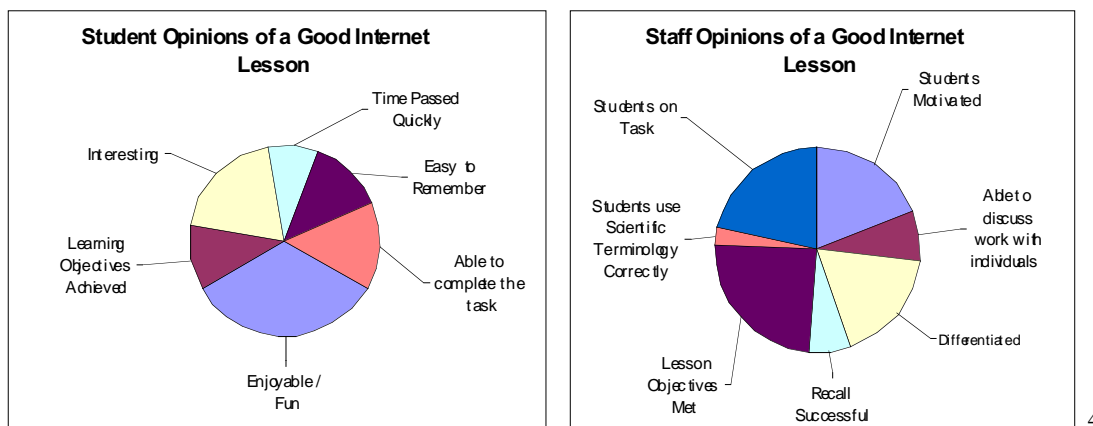
All of the interviews were conducted using a common format: Students were asked to express their views on the observed lesson, and then asked, “In your opinion, what makes a good Internet lesson?” All eighteen Science staff were also interviewed individually using the same format. Comments from all the interviews were analysed for similar responses.

The key themes from the baseline questionnaires and interviews are demonstrated in the following charts.



<sup>2</sup> IQEA: Improving the Quality of Education for All – the School’s improvement project.

<sup>3</sup> Data obtained from the baseline questionnaires



### Conclusion / Discussion

The original aim of this research project was to look at the level of structure required to deliver an effective lesson using the Internet.

From the interviews with staff and students, we were able to formulate the criteria for a “good” lesson using the Internet. The key elements that noted in observations were:

- Student motivation and involvement
- Student achievement
- Student understanding
- Applied methods of differentiation

A lesson was then deemed to be “good” if all aspects had positive notes.

- *Why use the Internet at all?*

The Internet provides up to date information beyond that available in standard textbooks. It can be relevant and motivational to a range of students with different preferred learning styles e.g. visual learners could benefit from colour animations plus sound is an option. Activities can be student-centred allowing individuals to work at their own rate.

- *How much freedom to explore the Internet should students be allowed in lesson)?*

The most effective lessons observed all followed a highly structured format. If the Internet is to be used effectively thorough planning is fundamental. The teacher must have knowledge of the suitability of sites and information contained. Every lesson should have a product e.g. poster, free writing, presentation etc.

- *What role should the teacher take at different stages of the lesson?*

The lesson should be introduced with a non-computer related hook and objectives for the lesson clearly presented. The Internet is merely another teaching tool and as such ground rules should be emphasised clearly from the outset (see Appendix 1 for examples). This will reduce classroom management issues in the longer term. Student-centred activities allow the teacher to take more of an advisory role. This can be used as an opportunity to circulate around the room and talk to individual students, assess their progress and question their thinking. At all stages the students should be monitored closely (effective use of NetOp School – network user-monitoring software – was observed on a number of occasions). Sufficient time must be allocated for review and discussion of the lesson objectives (a minimum of ten minutes is

<sup>4</sup> Data obtained from interviews with Science staff and students

recommended). Before students leave check that all computers are fully functional for use by the next class.

- *How are worksheets used most effectively?*

Although not essential, worksheets provide a useful reference for students when multiple web sites are to be used. Hard copies are easy to produce and allow students to make rough hand written notes. However, URLs may be mistyped causing frustration and reduced motivation. A word document on the school network will enable students to simply click on hyperlinks and present their findings electronically. Such resources can be stored as web pages and are more secure, as students are unable to amend them although they require more advanced technical knowledge to produce.

- *How can differentiation be best achieved both in terms of subject specific objectives and ICT abilities?*

Students with high attainment in a specific subject may have weak ICT skills and vice-versa. It is difficult to identify ICT ability; one possible way would be to consult the ICT co-ordinator and assessment data but nothing beats personal knowledge of individual students. There are opportunities for staff to set individual targets for their students. One lesson observed utilised e-mail as a method of providing activities in a personalised and private manner. Students were largely unaware that they were not all working at the same level and appreciated the individuality of the task. Web sites should be carefully selected to match the reading and comprehension abilities of students. A good web site will have all the required information within three clicks of the mouse. Careful consideration should be given to how many web sites are supplied and the time requirements for specific tasks.

- *How can opportunities for the development of students' personal study skills, responsibility and independence be built in as an integral part of a lesson?*

With the introduction of the new National Curriculum for ICT and Key Skills, there is an increasing need for opportunities for students to develop their ICT competency. The lesson could be structured to allow students to progress from very clearly defined, step-by-step tasks to more open-ended activities. Students should be encouraged to process information rather than simply copying or printing large amounts of data. As students' confidence in using ICT improves, Internet research activities can be set for completion out of the lesson, either in non contact time at school or as homework, optimising teacher contact time. This is particularly valuable in post-sixteen education, although opportunities for equal access to computers are of prime concern.

### Research Evaluation

It is hoped that the findings from this study will provide useful reference for colleagues in getting to grips with using the Internet in the classroom. Reviewing our findings there is little surprise that our recommendations follow guidelines for any lesson. E.g. Thorough planning, clear target setting, variety of differentiated tasks and student-centred with consideration of particular learning styles. We are confident in these well-documented suggestions for treating the Internet as simply a tool to facilitate learning in the classroom. Possibly more useful are the suggestions for structuring worksheets and monitoring student activity. These findings are based on lessons where students were observed to be enthusiastic about the activities and successful in achieving the lesson objectives.

These findings were presented at the Bedfordshire Schools Improvement Project Conference, held on 28<sup>th</sup> June 2001 at Wyboston Lakes, Cambridgeshire. This provided a valuable opportunity for colleagues from a variety of schools in our area to feed back their opinions on this research. The seminar was well attended and was felt to be of use to all participants.

There were considerable problems in organising this research. The major problem was one of time. The grant theoretically incorporated financial support for the provision of supply teachers to cover lessons, thereby freeing up research partners but our priority was, quite correctly, our own teaching groups. In an Upper school most students are engaged in preparation for external exams and we were reluctant to disrupt their teaching. As a result, discussion about the project was forced to be rather informal, and predominantly took place during our shared car journey to and from school. Possibly not the preferred setting for research, but nonetheless useful.

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The assistance of Julie Temperly in helping to design the baseline questionnaires and John Beresford (BSIP/IQEA Research Officer) in analysing the questionnaires was greatly appreciated.

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