

Bristol ChemLabS

A Centre for Excellence in Teaching and Learning

Annual Report 2006–07



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1. Introduction

Bristol ChemLabS will have been operational for two years on 31st March 2007 and it is one of the roles of the annual meeting of the Advisory Board to receive the Annual Report. HEFCE require an interim report after two years from all CETLs (due by 31st July 2007), and the Annual Report this year is therefore presented in the form of a draft version of the HEFCE Report required in four months time. The final Report to HEFCE will be in the form of a glossy which will contain several photographs and some short sections from other authors; these are not included here.

2. The Genesis of Bristol ChemLabS

The Bidding Process

In early 2004, the Higher Education Funding Council for England (HEFCE) announced an invitation for departments or consortia of departments in higher education institutions (HEIs) to bid for funds to become a Centre for Excellence in Teaching and Learning (CETL). In April of that year, the School of Chemistry (SoC) through the University of Bristol (UoB) submitted a bid to the Stage 1 process, the primary focus of which was to become a CETL in the teaching and learning of practical, laboratory-based chemistry for undergraduates. The Stage 1 bid made a strong case for existing excellent practice in this activity but stressed that future improvements in the teaching and learning of practical chemistry would become increasingly difficult without refurbishment of existing teaching laboratory infrastructure; a point strongly made in a University of Bristol Departmental Review in 2002. Accordingly, the Stage 1 bid requested a sum of £2m for capital projects in addition to £2.5m in recurrent funds to run the programme over the defined five-year period of CETL funding (£500k per annum). Both these sums were the maximum that could be bid for. The case for £2m for laboratory refurbishment was made stronger by a commitment from the University of Bristol to provide the additional funds required to complete the refurbishment together with further funds to re-clad and replace the windows of the School of Chemistry West Block, which houses the teaching laboratories. University of Bristol resources were also provided for the construction of some research space. In all, this University commitment amounted to a sum in excess of £16m.

Notification that the Stage 1 bid had been successful was received from HEFCE in June 2004 (nationally, 106 bids out of 259 were successful at this stage) and the School of Chemistry was invited to submit a bid to the Stage 2 process providing more details, specifically about budgetary matters and addressing issues that were raised as part of the feedback from the Stage 1 process. Notification that the Stage 2 bid had been successful, and therefore that the School of Chemistry had been awarded funding to become a CETL, was received from HEFCE in December 2004 (nationally, 74 such bids were successful) with a public announcement following in January 2005. Bristol ChemLabS (Bristol Chemical Laboratory Sciences), as the CETL is known, officially started on 1 April 2005 with a planned duration of five years and is the only CETL devoted to chemistry. The University of Bristol was also successful in securing funding for another CETL housed in the Faculty of Medical and Veterinary Sciences, the AIMS (Applied and Integrated Medical Sciences) CETL.

Later in 2005, HEFCE announced that additional CETL capital funds were available and that CETLs could submit bids for up to £350k. In December 2005, Bristol ChemLabS and AIMS submitted a joint bid for £700k for additional capital projects together with a request for further funds should these become available. In February 2006, notification was received from HEFCE that the bid for £700k had been successful and in April 2006, HEFCE acceded to a request for a further £335k in capital funding, £167.5k for each CETL. These additional capital funds are to be used to establish additional teaching space

by refurbishing existing 4th Floor link areas between the West and South, and South and East Blocks of the School of Chemistry as well as enabling in-fill building projects on the 3rd Floor.

Aims and Objectives

The original aim of Bristol ChemLabS was to have flexible, modern facilities and processes for the teaching and learning of the vital practical elements of chemistry. Its primary focus, therefore, is to engage, educate and enthuse students at all levels of experience and to create a major national resource for the teaching and learning of practical experimental science.

Specific objectives outlined in the Stage 1 and Stage 2 bid documents included:

- (i) The establishment of enhanced, e-facilitated, learning of practical chemistry for undergraduates and postgraduates. Central to this objective would be the development of a Dynamic Laboratory Manual (DLM) incorporating elements of an Electronic Laboratory Notebook (ELN).
- (ii) The construction of renewed infrastructure including: professional-standard laboratories; state-of-the-art instrumentation; facilities and materials for e-learning of modern laboratory chemistry.
- (iii) The hosting of: University Teaching Fellowships allowing staff to focus on educational innovation, School Teacher Fellowships for seconded schoolteachers; Continuing Professional Development (CPD) courses for chemistry educators and industrial scientists; outreach events to inspire students in pre-University education; public engagement events to inform a wider audience.
- (iv) Exporting enhanced protocols and methods for learning practical sciences into other Bristol contexts.
- (v) Disseminating new protocols and methods nationwide through the Higher Education Academy (HEA) and the Royal Society of Chemistry (RSC).
- (vi) Evaluating and devising ways of sustaining these activities, so that they may be embedded into the mainstream curriculum.

The extent to which these objectives have been realised in the first two years of operation is presented in the following Sections.

Management Structure

A project of the magnitude of Bristol ChemLabS requires careful management and a committed cohort of staff to ensure that all the aims and objectives are met. Accordingly, a Management Board and an Advisory Board have been established, the remits of which are given below.

The **Bristol ChemLabS Management Board** has overall responsibility for all matters relating to the running of Bristol ChemLabS including overseeing the performance of Bristol ChemLabS against the objectives, deliverables and milestones set out in the original bids. The membership of the Management Board is listed in Appendix 1. It meets 2–3 times a year, is chaired by the Head of the School of Chemistry and receives reports from the Chief Executive, the Director, the Manager, the Outreach Director and the University Teacher Fellow. The Bristol ChemLabS Chief Executive (CE) is responsible to the Bristol ChemLabS Management Board for delivery of its objectives, including its financial performance. The Chief Executive is a seconded senior member of academic staff in the School of Chemistry and is *ex officio* a member of its senior management and its (most senior) Planning Committee. The Chief Executive leads external relations of Bristol ChemLabS with the School of Chemistry, the Faculty of Science, the University and

its other departments, the Teaching Support Unit (TSU), the Learning Technology Support Service (LTSS) and the Graduate School of Education (GSoE), as well as the range of external partner organisations working with Bristol ChemLabS, including the Higher Education Academy (HEA), the Royal Society of Chemistry (RSC) and potential industrial sponsors. The Bristol ChemLabS Director is a seconded experienced member of staff in the School of Chemistry and leads the development of all educational matters to do with Bristol ChemLabS and is responsible for the management of its core staff with the assistance of the Bristol ChemLabS Manager. The Manager also has responsibilities for all matters relating to evaluation of the ChemLabS programme and is responsible for organising student involvement in the programme. The Bristol ChemLabS Outreach Director, together with the School Teacher Fellow, is responsible for all matters relating to outreach activities with schools and other organisations. The financial and other administration of Bristol ChemLabS is overseen by the School of Chemistry through its Director of Administration and the University Finance Office and is therefore subject to the robust and established accounting, audit and monitoring processes of the University. The Board reports to the University through the Faculty of Science and to HEFCE, the HEA and other stakeholders. The membership of the Board is largely Bristol-based but includes representation from key external partners, notably the HEA. The membership is designed to include executive and other senior members of Bristol ChemLabS (notably its Chief Executive, Director, Manager, Outreach Director and Teaching Laboratory Managers, together with senior members of the management team of the School of Chemistry (its Head, Directors of Administration, Undergraduate Studies and Graduate School) and students (undergraduate and postgraduate), as well as key University staff from outside Chemistry (the Faculty Education Director, Director of the TSU, Director of the University's other CETL, Graduate School of Education staff and the University of Bristol e-learning adviser).

The **Bristol ChemLabS Advisory Board** advises the Management Board on strategic matters and reviews the activities of Bristol ChemLabS in annual meetings and through receipt of the Bristol ChemLabS Annual Report prepared by the Chief Executive. The membership of the Advisory Board is listed in Appendix 1. It is chaired by the Pro-Vice Chancellor for Education and meets jointly with the Management Board. It is composed of senior members of the University (the Pro-Vice-Chancellor for Education and the Dean of the Faculty of Science), representatives of key external stakeholders and senior members of partner organisations.

Administrative support for all Bristol ChemlabS activities is provided by a full time secretarial appointment.

3. Teaching and Learning

Introduction

As outlined in Section 2, the primary focus of Bristol ChemLabS is to maintain and enhance excellence in the teaching and learning of practical, laboratory-based chemistry. The School of Chemistry established at the start of the CETL project a Working Party (WP) chaired by the Bristol ChemLabS Director that was charged with reviewing all aspects of the laboratory content. The membership of the Laboratory Working Party is shown in Appendix 1 and was chosen to represent key teaching (and research) interests from throughout the School of Chemistry and also included the two Teaching Laboratory Managers. Through its regular and frequent meetings over the last two years, the members of the Laboratory Working Party have considered all aspects of the laboratory experiments for the Level 1, 2 and 3 (first-, second- and third-year) laboratories, assessment of laboratory work and safety training.

Although work is still in progress, particularly for the Level 3 MSci laboratory, considerable revision of all the experiments has taken place, much more emphasis has been placed on assessed pre-laboratory work and in-lab assessment (as opposed to assessment of post-lab write-ups which will constitute a much smaller part of the laboratory experience) and considerable thought has gone into how best to ensure that the students are fully aware of the safety implications of the work they carry out. The process by which this work was carried out is outlined below.

History

In more traditional laboratories the students were expected to conduct the experiments without necessarily having a thorough understanding of the chemistry and procedures involved prior to arriving in the laboratory. In many cases, a cursory glance at the laboratory manual was all that occurred and it was only after the laboratory period, during (an often laborious) write-up, that the student gained some idea of what he or she had been doing during the practical. The new approach adopted by Bristol ChemLabS, principally realised through the Dynamic Laboratory Manual (DLM), has been designed to ensure that the student has a thorough understanding of the reactions, apparatus and chemicals that are to be used *before* the laboratory begins. Students will therefore get far more benefit from their time in the laboratory as they will actually understand what it is that they are doing at the time.

Another fundamental change which has been developed is the way that assessment is carried out. Traditionally, assessment is done remote from the laboratory based on a script handed in by the student. The approach adopted as part of the new ChemLabS laboratory experience is, as far as possible, to assess in the laboratory itself at the time the work is being done (in-lab assessment). This type of face-to-face contact with the student has many advantages. Thus, although assessment may be short, it is rich, individual and provides immediate, and therefore more useful, feedback to the student. It also provides a much more accurate degree of assessment and precludes plagiarism.

Skill Sets and Experiments

In designing a new laboratory, there is more than one way that the experiments and associated experience might be organised. It would be possible, for example, to have an experiment which illustrated an aspect of each lecture course. A broader (and superior) approach, however, was to decide upon a set of skills that would be expected of any chemist at the end of Levels 1, 2 and 3. Naturally, the skills from Level 1 would be built upon in Level 2 and still further at Level 3. The experiments that would illustrate and teach these skills were then designed and working from this skills foundation meant that broadly based *chemistry* experiments were developed instead of the more traditional organic, inorganic and physical experiments. Although, looking through a list of experiments, some can clearly be identified as being 'an organic experiment' there are many that transcend this structure. Examples include the 'superconductor experiment' in which an inorganic technique is used to demonstrate a physical phenomenon, the 'Wilkinson's catalyst' experiment where an inorganic catalyst is prepared and then used to catalyse an organic reaction, and the 'cycloaddition reaction' in which physical methods are used to follow the kinetics of an organic reaction. This approach had already been adopted by the School of Chemistry in a comprehensive re-design of the Level 1 laboratory in 2002. Bristol ChemLabS provided an ideal opportunity to do the same for the Level 2 and 3 laboratories. A list of Experiment titles for the Level 1 and 2 laboratories is given in Appendix 2 along with a table of the skills sets from which the experiments were designed. The Level 3 laboratory is still work in progress for which a planned start in October 2007 is anticipated.

The Level 2 Laboratory

There are 24 teaching weeks in the School of Chemistry and 24 experiments to be carried out in the Level 2 laboratory (the same is true at Level 1). This requires that each experiment must be able to be started and finished in one day but for many of the existing experiments, this was not possible using procedures from the literature in which, for example, a reaction might need to be stirred for 16 hours. Thus the experiments needed to be developed and modified and even those experiments which were found in the literature and appeared to be ideal needed to be tested. A number of Bristol Chemistry undergraduates were therefore employed over the summer of 2006 to work on these experiments and to modify and develop them in a way that met with the new requirements. Additionally, some third year project students were given, as a 9-week project starting in October 2006, the task of experiment development. For example, one student was told to find a way of getting a 16 hour experiment completed in 6 hours; he succeeded in finding a way of getting *three* 16 hour experiments completed in 6 hours.

Summer Laboratories

During the period before the laboratory closure for renovation in 2005, the two weeks after exams but before the end of term were used to run intensive summer laboratories (so-called 'bootcamps'). It was not reasonable to ask students to carry out and submit a detailed post-laboratory write up for an experiment when they had one every day and so the students were assessed in-lab and filled in a proforma which provided a structure for their oral assessment. Students responded so well to this method of teaching that it was decided it should become standard practice in a normal teaching year. However, although the 'bootcamp' was effective, it will form only part of the practical experience. Partly this is because many students have had very little practical experience and introducing them to the laboratory gradually through the usual laboratory timetable would be a necessary primer before any intensive period of laboratory work. The best time to have the 'bootcamp' was determined to be at the end of the first year.

First year honours chemistry students carry out the Level 1 course but so do many other honours students (biochemists etc.). This course finishes with the exams and the period after the exams is where the Level 2 work begins. Hence the bootcamp laboratories are designed only for those first year students who will be going on to do chemistry the following year (honours chemists). In designing experiments for the bootcamp there were two criteria. Firstly, it should introduce students to techniques they will encounter in the main Level 2 laboratory and secondly, the experience should be fun and have a significant 'wow' factor. Students who come to Bristol University to study chemistry for their degree will thus end the year on a high.

The Dynamic Laboratory Manual (DLM)

The DLM has been designed to incorporate several key features which are listed below:

- (i) Multiple choice pre-laboratory questions for each experiment assessed on-line with associated feedback;
- (ii) Multiple choice/completion safety assessment including scenario-based safety training;
- (iii) Interactive virtual instruments and equipment;
- (iv) Video clips of key practical techniques;
- (v) A techniques manual available as a key resource throughout the student's undergraduate career (and beyond).

The DLM therefore provides the student with everything they need to know about a practical experiment before they enter the laboratory. Access to the DLM can be gained

from anywhere so long as there is access to the Internet. As well as containing rich media such as video and animation, the DLM also provides the means to assess the students on their understanding and provides them with immediate feedback.

The DLM became available for Level 1 students in February 2007 when they entered the new laboratories and will be available for Level 2 students in October 2007 and Level 3 students the following year. It is planned that the DLM, which is part electronic laboratory notebook and is therefore personalisable by each student, will become a key resource for each individual student available throughout their undergraduate programme (and indeed beyond). It should be remembered that its role as an electronic laboratory notebook is not the principal function of the DLM which is in essence an educational tool rather than a data recording device. A demonstrator version will also be produced to assist post-graduate and staff demonstrators with in-lab assessment.

The Staff / Student Interface

The DLM operates via two pieces of sophisticated software: The freely available virtual learning environment 'Moodle' and a bespoke SoC system called 'Marks & Absences' (M&A). M&A is extremely powerful largely because the database can be interrogated in so many different ways; a given student can see exactly what experiments were (or will be) done on which day and all the associated marks, whereas a member of staff (or postgraduate demonstrator) can see exactly which students he or she needs to assess. The two pieces of software work seamlessly so that, through the visual interface of the DLM, a student would be unaware that there were two independent programmes.

A student who starts to work through pre-laboratory work has several things to achieve. The first of these is to work through the experiment information which is structured and may include videos or a simulation of the apparatus that is to be used. The student then has two assessments to undertake. The first of these, a Pre-lab test, is an online assessment to determine how well the student has understood the work. The questions asked are 'banked' so that another student doing the same experiment will be asked a different set of questions. The Pre-lab assessment counts towards the final mark for a given practical but the weighting will vary depending on the nature of the work. The student must also undertake an online Risk assessment dealing with the safety issues relating to each experiment. Students have two attempts to pass this test. A different set of questions will be used for the second attempt and, again, a different student will be asked different questions to minimise collusion.

A staff member, or postgraduate demonstrator, will have a page in their version of the DLM with a list of the students undertaking a particular set of experiments. A pass from a student gives rise to a green flag next to his or her name whereas a fail generates a red flag. It is easy to see at a glance if anyone has failed the test. A student who fails must speak to a member of staff about the safety issues who must then be satisfied that the student understands the safety issues before allowing the student to start in the laboratory. It was felt that human intervention if a student has failed twice was a better solution than allowing a student endless attempts at getting it right.

Level 3 Experiments

Both Level 2 and Level 3 experiments were identified in the early stages of the working party so that the course was designed across years as well as between Sections. Once this was done, the Level 2 experiments were worked out in detail. A similar procedure is being adopted for Level 3.

4. Capital Projects

The capital part of the ChemLabS project began during the summer of 2005 when the University approached architects and city planners regarding possible changes to the external appearance of the School of Chemistry and especially the West Block as it was recognised that the need for fume hoods on West Floors 5 and 6 would require considerable extra equipment on the roof. The University appointed architects and engineers to draw up preliminary plans around this time. Architects from Kendall Kingscott produced preliminary drawings of the existing and planned laboratories, while engineers from Silcock Dawson estimated the extent of the requirement for air-handling equipment, and an overall budget for the project was drawn up. Capita Symonds were appointed to manage the project on behalf of the University.

During the autumn of 2005 consultations with the School of Chemistry took place and small groups of chemistry staff were formed as the main contact points for the architects and engineers, although most communication was *via* the University Capital projects office. The City Council granted planning permission during the late autumn 2005.

The first work carried out was the construction of scaffolding around the outside of West Block. West Floors 5 and 6 were officially cleared and vacated by the School of Chemistry in mid-December 2005, and in early January 2006 a specialist contractor was appointed to strip out the interior. At the same time, the University appointed Cowlins as the main contractor for the construction work and the primary Cowlins site was constructed in the School of Chemistry rear car-park. During the early part of 2006 consultations continued about the fixtures and fittings in the laboratories, and the University issued outcome specifications for items such as fume hoods, benches, lighting and other services. In collaboration with School of Chemistry staff, architects and engineers, these were modified and finalised. School of Chemistry staff travelled to several other University Chemistry laboratories and manufacturers in order to ensure that best-practice was followed.

Cowlins started the construction phase of the project during spring 2006. This involved the removal of all windows from West Block and their replacement, the construction of a seventh Level to the building to contain all the air-moving equipment, and the installation of the services for the teaching and research laboratories; power, gases, and air-supply and extraction. Cowlins appointed Network Solutions as their sub-contractor to build the benches, and Mach-Aire to supply and fit the fume hoods.

During the summer of 2006, meetings began to coordinate the activities of Network and Mach-Aire, along with other contractors, to ensure that all of the sub-components of the laboratories worked well together and met the agreed specifications. Both companies provided mock-ups for University staff to view and test.

During the Autumn of 2006 the initial construction phase was completed and benches and fume hoods started to be installed; this work continued until the end of 2006. In parallel, sub-systems such as the local vacuum manifolds were installed by Vacuubrand. Rapid progress was made in installation, and by December 2006 the work was substantially complete. Commissioning of all mechanical and electrical systems began in early January 2007 and lasted until the end of that month. School of Chemistry personnel were allowed into the laboratories to begin the process of installing all of the equipment in mid January. In parallel, several external suppliers delivered new equipment and commissioned it *in situ*. Minor commissioning and snagging work is continuing.

School of Chemistry post-graduate student demonstrators were trained during early February 2007, and the laboratories formally opened for undergraduate teaching on Monday, February 19th 2007. Further work is planned; AV systems and wireless networks

will be installed in March/April 2007, and another 200 student PCs will be installed between then and October 2007.

5. Outreach

An Overview of Outreach Activities

During the first two years of Bristol ChemLabS a considerable number of Outreach activities have been undertaken, engaging people from 4 to 84 years of age. This activity encompasses four main areas namely primary schools, secondary schools, teachers and the wider community. Full details of all the many activities and events (past, present and future) are available in the Outreach section of the ChemLabS web-site at <http://www.chemlabs.bristol.ac.uk/outreach/>. The considerable increase in all aspects of Outreach activity has been facilitated by the appointment of the School Teacher Fellow (STF) Mr Tim Harrison for the duration of the CETL programme following an initial one-year secondment from his school since it was quickly evident that this was the best way to make full use of the available resources rather than to have a series of seconded teachers. The advantages of having a School Teacher Fellow have been reported in a preliminary paper¹ and will be evaluated again during the CETL period.

Working with Primary Schools

This activity constitutes a more unusual venture by an HEI science department but one which has proved very successful both through engagement in competitions such as Chem@rt and online quizzes or through visits to schools². The primary schools visits programme involves taking around £4,000 worth of equipment and two or three postgraduate chemists, converting a classroom into a makeshift laboratory for the day and running a circus of practical experiments with the pupils and staff. The running costs are about £680 to engage the entire school via a science assembly and around 65 Year 5 and 6 pupils for a day. Around 25 visits have been undertaken to date ranging from the South-West to London and Kent and with bookings up to 16 months in advance now being made. A list of these and other Outreach events are presented in the Tables in Appendix 3.

Working with Secondary Schools

The work with secondary schools has and continues to include many school conferences, spectroscopy tours, lecture demonstrations, practical workshops, summer schools and competitions which have³ engaged many thousands of students (Harrison and Shallcross, 2006 *Science In School*). ChemLabS has organised events from Wales to Central China and is currently working with the City of Bristol Local Authority as part of the RSC *Chemistry for our Future* project to increase science uptake by inner city school students.

Working with the Wider Community in Outreach Activities

Outreach activity in this area includes events for the scouting movement, public lectures, a school technicians' workshop and summer schools for the visually impaired.

¹ **The Role of the School Teacher Fellow**, D. E. Shallcross and T. G. Harrison, *Chemistry Education Research and Practice*, Volume 8 (1), January 2007. http://www.rsc.org/images/STF%20letter%20final_tcm18-76285.pdf.

² **Reaching out to Primary Schools: The Bristol ChemLabS Experience**, D. E. Shallcross, T. G. Harrison, S. Wallington and H. Nicholson, *Primary Science Review*, Issue 94, Sept/Oct 2006. http://www.ase.org.uk/html/members_area/journals/psr/pdf/psr-94/reaching.pdf.

³ **Perfume Chemistry, Sexual Attraction and Exploding Balloons: University Activities for School**, T. G. Harrison and D. E. Shallcross, *Science In School*, Issue 3, Winter 2006. http://www.scienceinschool.org/repository/docs/issue3_perfume.pdf.

Working with Teachers

ChemLabS has engaged in a number of teacher training activities ranging from those within the School of Chemistry to working in partnership with several Regional Science Learning Centres, the National Science Learning Centre and the Pan-European Science on Stage international science teachers' conference in Grenoble. These courses range from work on climate change and solar cells to teaching practical chemistry work to non-chemist chemistry teachers. Teachers accompanying school students at events also get a form of CPD by diffusion!

Working with Others

A range of additional activities undertaken is listed below:

- (i) The RSC has consulted with Bristol ChemLabS in preparation for the appointment of four School Teacher Fellows to be spread across England and ChemLabS expects to be involved in their appointment and training. ChemLabS is also working on a number of strands of the HEFCE-funded, RSC administered *Chemistry for Our Future* project, including the strand which involves Better Use of Labs; a comparison of ChemLabS use as compared with the purpose-built laboratory created at Sheffield.
- (ii) In the spirit of cooperation, a cluster of the Outreach workers in the Chemistry Departments at the Universities of Bristol, Warwick, Manchester, Southampton and Nottingham has been formed to share good practice. Cooperation with staff at the Universities of Cardiff, Plymouth and Brunel also exists.
- (iii) Internationally, a joint summer school has taken place with Trinity College Dublin and chemistry promotion has been discussed with the National University of Singapore and Wuhan University, China. Universities in Slovenia, Turkey, The Netherlands and Hungary are applying for funding for joint Outreach work with Bristol and ChemLabS has begun to work with representatives of the Ministry of Education in Brunei and expect to run teacher training courses in practical chemistry later this year as a prelude to much greater involvement in Chemistry Outreach.
- (iv) Along with the AIMS CETL, ChemLabS has worked together to pilot the use of the Mobile Teaching Unit in schools' Outreach. In its first pilot, over 750 students and around 20 teachers were engaged by three University of Bristol staff members in one day.
- (v) Several articles have been published or are in print that publicise the Outreach work at primary or secondary level in UK and international journals. These are listed in Appendix 3.

An unforeseen success of the Outreach work has been that over 100 postgraduate (PG) chemists from the School of Chemistry have been available for working with school students. They report very positively on their experiences and several overseas postgraduates are considering carrying on such work when they take up postdoctoral or other positions in their countries of origin. All postgraduate chemists have been trained through the Science and Engineering Ambassador Scheme (SEAS).

Evaluation of the Outreach work (see also Section 7) is undertaken using several methods. In-house and external (e.g. Aim Higher) questionnaires with students and/or teachers have been used on a number of occasions. Unsolicited e-mails, conversations with teachers, technicians, participating students and others contribute to the drive to increase further the quality of experience. For example, several schools have reported a doubling of A level Chemistry uptake by students having had experience of Bristol ChemLabS.

Requests for repeat events and invitations to national events such as science festivals also reflect prior appraisal by organisers. Appraisal of some teacher training activity has been done by RCUK (via an OfSTED Inspector) and by Professor John Holman ('Science Tsar'). The time put aside for regular reflection has been highlighted by Professor Kathy Sykes, Kohn Award winner in 2006. Further evaluation by others resulted in Dudley Shallcross and Tim Harrison being presented with the inaugural University of Bristol Science Faculty Engagement Award in 2007.

Future Plans for Outreach

Plans include the commercialisation of many outreach activities particularly with regard to long-term sustainability. This includes the use of the undergraduate laboratories on Wednesdays throughout the year for A-level and GCSE practicals and workshops, as well as week-long Chemistry Programmes for international students in schools from China, Singapore, Australia, India and the USA. These will sit alongside other University-desirable activities. In 2008 it is hoped to have developed 'SAGA' holidays for alumni and others who would come into the labs for weekend activities. Bristol ChemLabS also featured in Bristol's Engaged Universities Beacon application. A financial model has been devised that will allow all of these activities to be properly costed, ensuring that the costs to Bristol ChemLabS, or in the longer term, the School of Chemistry, can be recovered. The level of activity projected has resulted in a business plan being drawn up to ensure that funding for a School Teacher Fellow and others continues after the end of CETL funding.

6. Dissemination and Publicity

Effective dissemination of all the work carried out by Bristol ChemLabS is essential in order to ensure the success of each of the elements of the ChemLabS project. Thus Bristol ChemLabS is affiliated with a number of other organisations and groupings, providing efficient routes for dissemination. Within the higher education community, these partnerships include the Physical Sciences Subject Centre of the Higher Education Academy, as well as individuals at other universities across the UK. Links with professional bodies such as the RSC, the Association of British Pharmaceutical Industry and the Society of Chemical Industry (all of which have membership on the Advisory Board) provide further routes for dissemination.

In addition to the strong collaboration with organisations such as the Science Learning Centre and Bristol City Council, Bristol ChemLabS plays an active role in the Royal Society of Chemistry's *Chemistry for our Future* Project, providing a coordinated focus for dissemination of Outreach activities as outlined in Section 5.

Bristol ChemLabS has also been working closely with the AIMS CETL in order to maximise the opportunities for dissemination of activities both within the University of Bristol and further afield. A joint opening event is to be held in November 2007, with facilities in both CETLs formally launched by Professor David Eastwood, the new chairman of HEFCE. Bristol ChemLabS, along with AIMS, is also a member of the South West CETL cluster, facilitating dissemination to those outside the scientific community. Bristol ChemLabS and AIMS have also placed a joint advertisement in the House of Commons magazine in an attempt to raise the profile of both CETLs' activities to a wider audience of potential decision makers.

Key stakeholders have also been invited to visit Bristol ChemLabS, either as part of the first Stakeholder's Conference held in May 2005, or through a programme of individual visits. The opening of the new laboratory facilities will provide many further opportunities for dissemination and a further Stakeholder's Conference is planned for 2008.

Details of the many meetings, conferences, seminars and publications that have highlighted the activities of the Bristol ChemLabS team are given in Appendix 3.

7. Evaluation and Research

Evaluation Strategy

Effective evaluation of all of the activities associated with the Bristol ChemLabS CETL project is both necessary and desirable. HEFCE and the HEA have both identified a number of important reasons for such evaluation and on-going evaluation can provide important information for continuous development and improvement, ensuring that the project can build upon both expected and unexpected outcomes. Evaluation is also important in assessing the achievements and impact of the ChemLabS project, so enhancing knowledge and informing future developments in teaching and learning both within the University of Bristol and the wider higher education community. This evidence is useful for the further development of both the teaching of practical chemistry in particular and education in general. Evaluation is also essential to ensure accountability and to demonstrate to both HEFCE and the University of Bristol, as well as other stakeholders in the wider community, that the investment has been both worthwhile and effective.

A framework has therefore been devised to ensure the effective evaluation of all aspects of the Bristol ChemLabS project. The framework addresses each of the themes that must be addressed in the two-year Interim Evaluation document that is required by HEFCE and includes strategies for the evaluation of all aspects of the project, from experience of the new teaching laboratories to the effectiveness of Outreach activities. It includes the use of both qualitative and quantitative data and will draw upon information and experience from before and after the establishment of Bristol ChemLabS. The implementation and on-going development of the framework is overseen by the Evaluation Working Party whose membership is listed in Appendix 1.

Central to the strategy is the involvement of undergraduate and postgraduate students, as well as members of staff from across the School of Chemistry. Focus groups have been established for each year group of undergraduate students and the views of these focus groups have been especially useful in informing the team working on the development of the Dynamic Laboratory Manual. Separate groups of postgraduate students and staff from outside the direct ChemLabS team are shortly to be convened now that the teaching laboratories have reopened. In future, it is expected that a focus group of employer stakeholders will also be established in order to evaluate the effectiveness of the Bristol ChemLabS project on improving the practical skills of graduate chemists from the University of Bristol. Meetings of the focus groups are coordinated by external facilitators in order to ensure that members feel able to provide honest and critically constructive views of the project.

Spot interviews have also been conducted with undergraduate students working in the new laboratories. Performing such interviews on a regular basis will allow an assessment of how students' impressions and experiences change with time as the new teaching laboratory course becomes embedded into the curriculum.

Student questionnaires have long played an important part in the evaluation of the effectiveness of teaching and learning across the School of Chemistry, and those for the practical course will form an important source of information for the evaluation process. A comparison of student achievement will also provide quantitative information about the impact of the Bristol ChemLabS developments on undergraduate teaching. It is not anticipated that the overall level of achievement, as measured by the marks obtained by students, will necessarily change, even though the nature of the assessment in the new laboratory course is now significantly different to what has gone before. It will nevertheless be important to consider the effect of the developments on the motivation and therefore attendance and participation of students.

The impact on the wider University of the developments in both the Bristol ChemLabS and AIMS CETLs will be evaluated by textual analysis of individual activities. Interviews between staff involved in each CETL and with senior University staff such as Faculty Education Directors will also allow an evaluation of how much other subject areas have been able to learn from the activities of each CETL. In addition, the interviews will demonstrate whether the CETLs have caused a change in University policy and practice and raised the profile of teaching-related activities in reward, recognition and promotion. In each case, the involvement of both CETLs in these activities will provide an invaluable comparison of methods and impact.

An important element of the evaluation strategy is the appointment and involvement of Dr Stuart Warren, of the Department of Chemistry at the University of Cambridge, to act as an External Evaluator. The role of the External Evaluator is to provide informed and unbiased comment on all aspects of the project, including the aims and objectives, the process and structure, the educational developments and the academic standards achieved. Dr Warren will therefore have responsibilities in each of the areas highlighted by HEFCE and the HEA. He will be expected to perform independent and impartial evaluation, as well as helping the ChemLabS team in its own evaluation. It is not intended that Dr Warren be involved specifically in the initial development but will instead help in evaluation at various intermediate stages throughout the project and at the end of the formal period of CETL funding. As a senior academic chemist, Dr Warren has significant experience, and will therefore be in a strong position to compare subject-specific practice and achievement within the CETL with that at other higher education institutions both in the UK and worldwide. He is well qualified to consider the content and delivery of the practical courses and understands the challenges involved in engaging future generations of chemists through outreach activities.

HEFCE Interim Evaluation

The framework for evaluation of the CETL's activities has been developed, in part, using the guidance offered by HEFCE for the preparation of the Interim Evaluation document required in July 2007. It is expected by HEFCE that each Interim Evaluation should include both outward- and inward-facing components with certain areas of the evaluation common to both. The text of the Bristol ChemLabS Interim Evaluation document will be based on this Annual Report, with additional guidance to allow readers to make direct comparisons with the Evaluation Reports produced by other CETLs. It is anticipated that certain sections that refer to University-wide developments will be common to both the Bristol ChemLabS and AIMS reports. These include a review of the impact of both CETLs on teaching and learning strategies across the University of Bristol as well as their influence on reward and recognition processes. It is also hoped that commentaries from Advisory Board members and other key stakeholders will be included in order to provide an external perspective on the evaluation of the project. The Interim Evaluation document will be produced in a high-quality format with an accompanying DVD that will include an interactive demonstration of the Dynamic Laboratory Manual and a virtual tour of the new teaching laboratory facilities.

Educational Research

In addition to the pedagogic research that forms part of the inherent evaluation of the core activities of the project, members of the Bristol ChemLabS team are also engaged in wider ranging educational research projects. Some of these, including those focussing on the role of the School Teacher Fellow, have already been published. The Bristol ChemLabS team is also developing partnerships with both internal and external researchers, including members of staff from the Graduate School of Education at the University of Bristol and the Centre for Excellence in Experiential Learning in Natural and Environmental Sciences at the University of Plymouth.

8. Sponsorship and Commercial Activities

An important part of both the Stage 1 and Stage 2 bids to HEFCE to become a CETL was to demonstrate that consideration had been given to long-term sustainability. Thus, whilst the HEFCE (and University of Bristol) capital and recurrent funding would provide the initial investment for Bristol ChemLabS over the five-year timeframe of the CETL programme, its financial viability beyond that time was important to demonstrate.

As described in the Sections above, the primary focus of Bristol ChemLabS is to provide an excellent environment for the teaching and learning of laboratory-based practical chemistry for undergraduates. It is the responsibility of the School of Chemistry to provide and maintain the best possible environment. However, the level of initial investment in the construction and, in particular, the equipping of the new teaching laboratories has been to such a degree that additional sources of income will be needed to maintain the operation at its starting level. It is in this regard, and indeed with regard to enhancing further the laboratory experience, that commercial sponsorship is being sought.

A key aspect in seeking external sponsorship is the concept of 'added value'. Thus as stated above, it is the responsibility of the School of Chemistry to maintain a well-found laboratory in which to educate undergraduate students and it is important that this message is clear to potential sponsors. Nevertheless, the reality of the situation is that the level of initial investment in new laboratory equipment and instrumentation has been to such a degree that the School will only be able to maintain a certain, albeit high, level of provision without long-term external support. Added value goes beyond mere maintenance of provision, however. Additional resources will enable even more ambitious activities to be undertaken which will enhance the student experience still further. To date, a number of carefully selected potential sponsors (stakeholders who have a key interest in the training of undergraduates to the highest possible standards) have been invited to visit Bristol ChemLabS and during their visit, they have received presentations from senior ChemLabS staff and discussions have taken place about possible means of sponsorship. These discussions have ranged widely and the types of sponsorship which have been considered include not only cash donations but also equipment/instrumentation purchase by the sponsor and provision of an income stream through commercial use of the teaching laboratories for industrial training and Outreach activities. In this regard, the fundraising has been linked to the University of Bristol 2009 Centenary Campaign (ChemLabS is one of around 20 University projects highlighted in the Campaign) and efforts are therefore coordinated with the University of Bristol Campaigns and Alumni Relations Office. It is important to recognise that sponsorship is not a one-way street and that whilst the benefits of sponsorship are clear for ChemLabS, the benefit to the sponsor is just as crucial. With this in mind, a gift recognition list has been drawn up which clearly states what benefits accrue to the sponsor for a given level of investment.

In addition to the use of the teaching laboratories for School of Chemistry undergraduates, it is planned that the laboratories will be used for a broad range of schools Outreach and public engagement events. These activities are described in detail in Section 5 but it is important that in the long term, all Outreach/Engagement becomes financially self-sustaining. A detailed Outreach business plan has therefore been prepared in which all activities are fully costed and priced. It is expected that by the end of the initial five-year CETL period, Outreach/Engagement will not only be self-sustaining but will provide an income stream to support other ChemLabS activities.

Commercial opportunities for Bristol ChemLabS are also being considered. One aspect focuses on the wider use of the teaching laboratories, as highlighted above, in terms of potential industrial use (for training and other activities) and use for Outreach/Engagement activities. The laboratories are only occupied by Bristol undergraduates for 24 weeks of the year and even during this time, they are not used on Wednesdays; to do nothing with the laboratories for what amounts to half a year is a waste of resource. In addition to

laboratory usage, there are a number of other possibilities being considered for future commercial development. Primary amongst these at present is the potential to develop a version of the Dynamic Laboratory Manual for A Level practical courses and discussions are underway with the A-Level exam boards, IMPACT Faraday and the University of Bristol Research, Enterprise and Development (RED) office. Bristol ChemLabS is already a registered Trademark.

9. Finance

The Capital part of the ChemLabS funding has been administered through the University of Bristol projects Office. The £500k per annum of recurrent funding is administered directly by Bristol ChemLabS through the School of Chemistry. Details for the first two years of ChemLabS operations are shown below. The column for Year 1 represents the actual spend whilst that for Year 2 is the spend to date.

Bristol ChemLabS (CETL)	CETL Year	
	1	2
	01/04/05 31/3/06	01/04/06 31/3/07

Staff Expenditure

University Teaching Fellow	15000	15000
University Teaching Fellow	8733	15000
Teacher / Outreach Fellows	28399	20285
CETL Manager	31597	50500
Secretary/administrator	15872	24241
Evaluators/Academic Auditor	46	0
CETL Chief Exec honorarium	3000	3105
CETL Director honorarium	2000	2070
CETL Chief Executive research support	10980	24950
CETL Director research support	11245	31000
Teaching Laboratory manager	31475	34100
Teaching Laboratory manager	9387	9620
Technical staff	36000	46313
Indirect cost	97000	0

Non Staff Expenditure

IT development and maintenance	119151	140677
lab costs (School)	15900	15000
IT Infrastructure costs	6130	474
Office/Administration costs (CETL)	20292	7362
Office/Administration costs (School)	5249	3461
Travel/Entertainment	0	1150
Audit (Finance Office)	2000	2000
Dissemination/Publicity	6551	3774
Outreach	25075	33755

Total Expenditure	501082	483837
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Total Recurrent Funding	500000	500000
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Appendix 1: Membership of Boards and Committees

Membership of Bristol ChemLabS Management Board

Chair: Head of School of Chemistry	Professor T C Gallagher (SoC)
Bristol ChemLabS Chief Executive	Professor N C Norman (SoC)
Bristol ChemLabS Director	Dr P J Wyatt (SoC)
Bristol ChemLabS Outreach Director	Dr D E Shallcross (SoC)
Bristol ChemLabS Manager	Dr D M Smith (SoC)
School of Chemistry Director of Administration	Dr D W Thompson (SoC)
School of Chemistry Director of Undergraduate Studies	Dr P J Wyatt (SoC)
University Teacher Fellow	Dr R J Cox (SoC)
School Teacher Fellow	Mr T G Harrison (SoC)
Director of Graduate School of Chemistry	Professor A J Orr-Ewing (SoC)
Teaching Laboratory Managers	Dr T M Obey (SoC)
	Dr T J Podesta (SoC)
Student representatives (from SSLC and GSC)	Mr J Elsworth (PG, SoC)
	Miss J Vickery (PG, SoC)
	Miss J Howells (UG, SoC)
	Miss L Smith (UG, SoC)
Director, University of Bristol Teaching Support Unit	Ms G Clarke (TSU)
Faculty of Science Education Director	Mr J Bailey (SoGS)
Senior representative of Graduate School of Education	Dr S Erduran (GSoE)
Representative of HEA Subject Centre in Physical Sciences	Mr P Chin (HEA)
Director of the University of Bristol AIMS CETL	Dr J Harris (Physiology)
University Academic e-Learning Adviser	Dr B Miller (DoCVS)

PG = postgraduate, UG = undergraduate, SoGS = School of Geographical Sciences, SSLC = Staff-Student Liaison Committee, GSC = Graduate School Committee, AIMS = Applied and Integrated Medical Sciences. DoCVS = Division of Clinical Veterinary Science.

Membership of Bristol ChemLabS Advisory Board

Pro-Vice Chancellor for Education, University of Bristol	Professor A E Waterman-Pearson
Dean of Faculty of Science, University of Bristol	Professor A G Orpen
Royal Society of Chemistry	Ms L Steele
Society of Chemical Industry	Mr A Ladds
School of Chemistry Industrial Advisory Board	Dr D Lathbury (AstraZeneca)
Chair of HCUK (Heads of Chemistry UK)	Professor S Chapman (Edinburgh)
Students' Union President, University of Bristol	Mr B Ullmann (UoB Union)
External Academic Evaluator	Dr S Warren (Cambridge)
Head of Education, The Association of the British Pharmaceutical Industry (ABPI)	Mrs Sarah Jones

Membership of Bristol ChemLabS Laboratory Working Party

Chair: Bristol ChemLabS Director
Bristol ChemLabS Manager
Teaching Laboratory Managers

Technical Staff Representative
School of Chemistry Director of Administration
Academic Staff Section Representatives

Dr P J Wyatt (SoC)
Dr D M Smith (SoC)
Dr T M Obey (SoC)
Dr T J Podesta (SoC)
Mr S Croker (SoC)
Dr D W Thompson (SoC)
Dr I Bull (SoC)
Dr C P Butts (SoC)
Dr J Charmant (SoC)
Dr R J Cox (SoC)
Professor R P Evershed (SoC)
Dr E McGarrigle (SoC)
Professor A Orr-Ewing (SoC)
Dr C A Russell (SoC)
Dr C M Western (SoC)

Membership of Bristol ChemLabS Evaluation Working Party

Chair: Bristol ChemLabS Manager
Bristol ChemLabS Chief Executive
Senior representative of Graduate School of Education
Director, University of Bristol Teaching Support Unit

Dr D M Smith (SoC)
Professor N C Norman (SoC)
Dr S Erduran (GSoE)
Ms G Clarke (TSU)

Appendix 2: Level 1 and 2 Experiment Titles and Skills Sets

The Level 1 Laboratory

Level 1 experiments run for 3 hours once a week for 24 weeks. Students are expected to complete pre-laboratory work before they come to the laboratory itself. The pre-lab contains several components: (i) an introduction to the experiment so that the students understand what it is that they will be doing, (ii) an online assessment to examine how well they understand, and (iii) an online safety test.

Assessment is based upon the pre-lab, in-lab assessment by demonstrators and staff and some assessment of post-lab activities based on the laboratory work carried out. Long writeups for every experiment are not a feature of the experience at Level 1.

Experiment Titles

1. Oxidation States of Tin Compounds: Tin (IV) Iodide & Tin (II) Chloride
2. Stoichiometry: Preparation and Spectroscopic Analysis of a Copper-Glycinate Complex
3. Recrystallisation in the Purification of *trans*-Stilbene
4. The Reaction of Benzylamine with Benzoyl Chloride
5. Acid/Base Equilibria
6. Thermochemistry
7. The Preparation of Transition Metal Acetylacetonate Complexes
8. Stability Constants of Silver Complexes with Amines
9. The Reduction of Benzophenone to Diphenylmethanol
10. Separation and Extraction
11. Chemical Kinetics I – Diazonium Salt Decomposition
12. The Viscosity of Gases
13. The Preparation of some Four-Coordinate Nickel Complexes
14. The Resolution of a Racemic Mixture of Transition Metal Complexes
15. Esterification and Distillation: The Preparation of Isoamyl Acetate
16. Aldol condensation: Dibenzalacetone
17. The Enthalpy of Combustion of an Alcohol
18. The $2\text{NO}_2 - \text{N}_2\text{O}_4$ Equilibrium
19. Magnetochemistry
20. The Chemistry of some Compounds of Boron
21. The Dehydration of *tert*-Amyl Alcohol
22. Vibrational-Rotational Spectrum of Germane and UV Spectroscopy: 'Particle in a Box'
23. Chemical Kinetics II – The Hydrolysis of Ethylformate
24. Enthalpy of Vaporisation from Flow Calorimeter Measurements
25. Enthalpy of Vaporisation from Vapour Pressure Measurements

The Level 2 Laboratory

Level 2 experiments take place for 6 hours per week for 24 weeks. This will be complemented by an intensive session of 7 hours per day for 8 days which will run over a two week period after the examination period in the first year.

Intensive Summer Laboratory Experiments

- B1. The use of Grignard Reagents: The Preparation and Reactions of Triphenylmethanol
- B2. The Reduction of 2-benzofuranylmethyl ketone using NaBH_4 and a Carrot.
- B3. An Introduction to Chromatography: Extraction and Analysis of Caffeine
- B4. The Synthesis and Characterisation of a 'High'-Temperature (77K) Superconductor
- B5. The Synthesis of Chromium(II) Acetate: An Introduction to Inert Atmosphere Synthesis
- B6. Calculation of Molecular Structure, Energetics and Spectra using Gaussian
- B7. Scientific Writing: Keeping a Good Lab Notebook
- B8. An Introduction to Electrochemistry

Level 2 Experiment Titles

- 1. Thiazolium catalyst and stereochemistry in the Synthesis and Reduction of Benzoin
- 2. Aromatic Electrophilic Substitution: The Preparation of 4-Bromobenzophenone by the Friedel-Crafts Reaction
- 3. The Synthesis of Stillbene: The Wittig Reaction
- 4. Cycloaddition Reactions and their Mechanisms: $4\pi + 2\pi$ and $2\pi + 2\pi$ Reactions Compared
- 5. Sequential Aldol and Michael Addition Reactions followed by Pyridine Synthesis
- 6. Heterocyclic Chemistry: The Guareschi-Thorpe and the Vilsmeier Reactions
- 7. The Preparation and Use of Wilkinson's Catalyst: The selective Reduction of Carvone
- 8. Chromatography in Action
- 9. Electrochemistry
- 10. Molecular Spectroscopy
- 11. Absorption and Fluorescence of Dye Molecules
- 12. The Stability of Colloidal Particles
- 13. Chemical Kinetics
- 14. The Properties of Surfactants
- 15. The Solution Properties of Polyelectrolytes
- 16. Infrared spectroscopy
- 17. The Nickel Catalysed Isomerisation of But-1-ene
- 18. Mesoporous Silica formed by Supramolecular Templating/Inorganic Polymers: The Preparation and Properties of Bouncing Putty
- 19. Monomeric and Polymeric Transition Metal Oxides
- 20. The Synthesis and Spectroscopic Characterisation of Metal Carbonyl Complexes
- 21. The Application of Liquefied Gases as Non-Aqueous Reaction Media
- 22. Tracing Chlorophyll in Sediments using Chromatography and Visible Spectrophotometry
- 23. Ferrocene: Synthesis and Reactivity
- 24. Preparation of a Luminescent Copper(I) Complex

Practical Skill Sets for Undergraduate Chemists

Level 1

Practical

Identifying & assembling glassware;
What equipment is eg what a Hirsh Funnel looks like;
What kind of containers to use;
Location of laboratory apparatus;
All basic laboratory skills eg recrystallisation;
Making and measuring solutions accurately;
Instrumentation;
Using Vernier scales;
Data-handling and taking observations in a coherent fashion;
Cleanliness of glassware;
Basic synthetic skills;
IR;
TLC.

Safety

Following instructions;
Working in a safe manner;
Minimising danger to themselves and those around them.

Measurements

Following detailed instructions - acceptable experimental data;
Recording accurate, reproducible data;
Understanding the importance of testing/calibrating apparatus;
Keeping accurate, detailed laboratory notebooks;
Using software to record data.

Data

Following instructions to analyse data;
Introduction to using spreadsheets to analyse data;
Demonstrate whether a set of data agrees with a given theory.

Writing

Presenting data in tabulated and graphical format;
Writing figure legends;
Report writing;
Presenting detailed reports;

Level 2

Practical

Distillation;
Dry preparations, reagents handling;
Handling BuLi;
Small scale synthesis/precious metal handling;
Solid state synthesis;
Gas handling;
Vacuum/inert atmosphere techniques;
Choosing an appropriate technique to address a problem;
Anticipating results - performing/designing experiments accordingly;
Prediction of outcomes as part of experiment planning;
Developing robust experimental protocols;
Understanding the importance of control experiments;
Standard manipulations under inert atmosphere including filtration;
Use of IR to follow reaction;
HPLC.

Safety

Basic knowledge of risk assessment - how to minimise risk;
Being aware of COSHH.

Measurements

Recording accurate, reproducible data;
Understanding the importance of testing and calibrating apparatus;
Understanding how Signal to Noise can be improved;
Keeping accurate, detailed lab-books;
Using software to record data.

Data

Confidence in using spreadsheets to analyse data;
Demonstrate whether a set of data agrees with a given theory;
Drawing inferences from data sets;
Identifying sources of error in a procedure;
Propagating errors.

Writing

Crossfire/Web of Science;
Chemical Abstracts;
Aldrich Catalogue;
Writing an abstract;
Giving complete and appropriate references;

Presenting detailed reports for short experiments/extended projects.

Level 3

Practical

Use of low temperatures;
Demanding Small scale synthesis (10-20mg);
Solid state synthesis;
Gas handling;
Standard manipulations under inert atmosphere including filtration;
Advanced Vacuum/inert atmosphere techniques;
Choosing an appropriate technique to address a problem in complex situation;
Anticipating results and performing and/or designing experiments accordingly;
Designing a series of experiments to test a hypothesis;
Use of IR to follow reaction.

Safety

Filling in own COSHH form.

Measurements / Data

Diagnosing problems with malfunctioning apparatus;
Appreciating the strengths and weaknesses associated with "black box" instruments;
Understanding how Signal to Noise can be improved.

Writing

Crossfire/Web of Science;
Chemical Abstracts;
Keeping accurate, detailed lab-books.

Transferable Skills

Presenting experimental results orally;
Preparing a research poster;
Participating in group exercises;
Teamwork.

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Awards

Date	Title	Awarded to
23/06/2005	RSC Higher Education Teaching Award	Dudley Shallcross
23/06/2005	RSC Schools Education Award	Tim Harrison
16/11/2005	Faculty of Science 2005 Teaching Prize	Dudley Shallcross
12/12/2005	Faculty of Science 2005 Rising Star Prize	Duncan Wass
01/12/2006	The SCI Science Education Award	Dudley Shallcross
10/01/2007	Faculty Teaching and Learning Prize	DES, TGH

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Outreach

Date	Title	Location	Audience Category	How Many Participants
30/09/2005	Tim Harrison, OCR GCSE 21st Century Science Teachers meeting to look at changes in National curriculum effective 09/06	Nottingham Airport		
	Teachers Workshop	School of Chemistry	Teachers	
25/01/2005	Sixth form Chemistry Conference Biochemistry /Medical Chemistry	University of Bristol	Secondary	
	Sixth form Chemistry Conference Biochemistry /Medical Chemistry	University of Bristol	Secondary	
09/05/2005	Show and Do Teacher Training in demonstrating exciting Chemistry practicals II	School of Chemistry		
01/06/2005	Trials of Y9 Chemistry On-line Quiz using Blackboard	Rednock School		
25/06/2005	VIP Summer School	School of Chemistry	Visually impaired students aged between 20 and 80+ with their sight guides	
01/07/2005	Show and Do Teacher Training in demonstrating exciting Chemistry practicals I for Regional Science Centres - South West	School of Chemistry	Teachers	8
05/07/2005	ALCOPOPS	School of Chemistry	Secondary	14
01/09/2005	Tim Harrison officially started post	School of Chemistry		
04/09/2005	Sutton Trust summer school	School of Chemistry		
05/09/2005	BA Science Festival at Trinity College Dublin	Trinity College, Dublin		
	Higher Education Summer School	School of Chemistry		

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Title	Location	Audience Category	How Many Participants
23/09/2005	Royal Institution Express Yourself Final			
06/10/2005	Nottingham University Chemistry	University of Nottingham		
11/10/2005	Visit to Wallop Defence Systems	Middle Wallop Hampshire		
13/10/2005	Warwick University Chemistry Department Ten Beautiful Experiments, lecture by Philip Ball	Warwick University		4 year 13 from Rednock
	Meeting with Dan Persaud from Warwick University	Warwick University		
18/10/2005	Meeting with Dr June Tweney, Regional Science director of the Open University South West	School of Chemistry		
19/10/2005	Visit Dr Annie Hodgson, Chemistry Department York University	York		
19/10/05	Meeting with Prof John Holman, Science Learning Centre HQ York	Science Learning Centre HQ York		
21/10/2005	Meeting with RSC seconded teacher	School of Chemistry		
24/10/2005	Visit by Dr Kate Burrell RSC AimHigher National co-ordinator	School of Chemistry		
25/10/2005	Ambassador Training	School of Chemistry		25 postgrads
27/10/2005	Meeting with Dr Andrew Marsh, University of Warwick and lecture.	University of Warwick		
31/10/2005	Nuffield Bursary Scheme 2005			
	Meeting with Vicky Barwick, LGC	School of Chemistry		
07/11/2005	Top of the Bench	School of Chemistry	Secondary	9 schools, 10 teams
09/11/2005	Chemistry Conference Chemistry Week	School of Chemistry	Year 11 to 13 and their teachers from over twenty schools	Around 440

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Title	Location	Audience Category	How Many Participants
16/11/2005	Chemistry Conference (overspill)	School of Chemistry	year 11,12 &13 and their teachers	255
21/11/2005	Science on Stage	Geneva		
26/11/2005	Perfume Chemistry Workshop Trial	Badminton School	Secondary	
30/11/2005	Structure and Bonding Workshop and Lecture	Cotham School and Redland's High school		
30/11/05	Year 10 Structure and Bonding Workshop	School of Chemistry	KS4	
01/12/2005	Primary Science Day	St Mary's Thornbury		
05/12/2005	Brooke Weston CTC visit	Corby, Nothants		
09/12/2005	Sharing Good Practice in Outreach Activities	University of Warwick		
12/12/2005	Spectroscopy tours	School of Chemistry	Secondary	
13/12/2005	EEF Skills Conference	Engineer's House, Bristol		
14/12/2005	Training in the use of Grätzel cells	School of Chemistry	Teachers	
15/12/2005	Spectroscopy tours	School of Chemistry	Secondary	
03/01/2006	AS and A Revision Workshops	Rednock School, Gloucs	GCSE	17
	AS & A2 Revision Workshop	Rednock School, Dursley	Years 12 and 13	14+8
16/01/2006	CREATE meeting	University of Bristol		
18/01/2006	Meeting at School of Chemistry, University of Manchester	University of Manchester	Lecturers	
23/01/2006	Gloucestershire Science Colleges Cluster Meeting	Winchcombe School, Gloucs	Teachers (secondary)	5
25/01/2006	Sixth form Chemistry Conference Biochemistry /Medical Chemistry	School of Chemistry		240 students and their teachers
26/01/2006	RSC Joint Evening Conference: Elements of Murder	School of Chemistry	Secondary, KS3, UG, PG	
27/01/2006	Language CETLs meeting		Lecturers	

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Title	Location	Audience Category	How Many Participants
	CETLs/LLAS Subject Centre meeting	Royal Society of Medicine, London		
30/01/2006	St Michael's Church of England Primary School	Winterbourne	Primary	
	St Michael's Science Week Activities	St Michael's Primary School, Winterbourne	Year 5 and 6/whole school assembly	200 pupils + staff
	Primary School Visit	St Michael's Primary School, Winterbourne	Primary	Assembly for around 200, workshops for 34 year 6 s
01/02/2006	kingswood primary school			
02/02/2006	Chemical Education Group Seminar	London		
	WISE Event	Malmesbury School, Wiltshire	Year 9	25 young women
04/02/2006	Perfume Chemistry Workshop for Undergraduates	School of Chemistry		
06/02/2006	Bristol Grammar School Hoffman restored	Bristol Grammar School		
08/02/2006	Paxcroft School's Science Week activities	Paxcroft School	Years 4, 5 and 6	270 pupils + staff
14/02/2006	NERF workshop	London	lecturers, educationalists	
20/02/2006	Chemistry Enrichment Day	Severn Vale School, Gloucester	Year 10	
21/02/2006	Trinity College Dublin			
24/02/2006	Mike Butters, AstraZeneca			
06/03/2006	Warwick University Outreach Meeting			
08/03/2006	Science Communicators Poster Presentations for Regional Science Colleges	School of Chemistry	KS4 students from regional science colleges	12

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Title	Location	Audience Category	How Many Participants
09/03/2006	Malmesbury School CO2 monitoring			
15/03/2006	Science Week Schools' Conference	School of Chemistry	School students and School of Chemistry students and staff	
15/03/2006	Science Week Visit	Bruton School		
	Talk by DES	Southampton Chemistry		
16/03/2006	Schools Chemistry Lectures (Food Chemistry)	School of Chemistry		
17/03/2006	GCSE Chemistry Revision	St Katherine's School	Year 11	
18/03/2006	Science Alive!	Broadmead Galleries Shopping Centre		
19/03/2006	Chemistry 'Magic Show'	St Michaels on the Mount		
20/03/2006	Chemistry 'Magic Show'	Embleton Primary School, Southmead	Year 6 and Year 5 pupils	
24/03/2006	A Level Chemistry Enrichment Afternoon	Norton Hill Science College	Post 16 chemists (Year 12 and 13 chemistry students)	
27/03/2006	Weston School Consortium Visit to Chemistry	School of Chemistry	Year 10 students from several schools in Weston Super Mare	40
28/03/2006	Interview of TJP and TGH by Sandie E Llewelin, Graduate School Education	Univeristy of Bristol		
30/03/2006	University of Leeds, Andrea Jackson			
05/04/2006	Wales 2006 Physical Science Revision Lectures with Institute of Physics	Ysgol Gyfun Cwm Rhymni - Blackwood, Caerphilly	Year 11	
06/04/2006	Wales 2006 Physical Science Revision Lectures with Institute of Physics	Ysgol y Preseli, Crymych, Pembrokeshire	Year 11	

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Title	Location	Audience Category	How Many Participants
07/04/2006	Wales 2006 Physical Science Revision Lectures with Institute of Physics	Rhyl High School, Denbighshire	Year 11	
26/04/2006	Chemistry Day	Kingswood County Primary School Gloucs.	Assembly: whole school; workshops: years 5 and 6.	Assembly: whole school; workshops: 34.
04/05/2006	AS Level Revision Session	Rednock School		18
05/05/2006	Perfume Chemistry Workshop		Year 10 students	
08/05/2006	A Pollutant's Tale' lectures	Castle School, Thornbury	Year 12 General Studies students	Around 100
23/05/2006	Second National Conference for Chemistry: the Next Generation	Birmingham		
05/06/2006	Aimhigher Chemistry Days	Biochemistry laboratory, University of Bristol	Year 10 students and their teachers	Around 210
06/06/2006	Chem@rt Presentations	DETAILS		
14/06/2006	Climate Change Course	National Science Learning Centre, University of York	Secondary school teachers, NQTs, teaching key sta	17
15/06/2006	Chemistry and Food Demonstration Lecture	Rednock School	Year 10 students	50
16/06/2006	Perfume Chemistry Workshop	School of Chemistry		32
19/06/2006	Using Demonstrations and Practical to enthuse KS3 & KS4 Chemistry Students	School of Chemistry	Teachers	
20/06/2006	Cheltenham festivals meeting	Cheltenham		
21/06/2006	Atmospheric Chemistry Update for Chemistry Teachers	School of Chemistry	Chemistry teachers	
26/06/2006	RCUK / Science Learning Centre South West Climate Change Course		Teachers from the South of England	18
27/06/2006	Three outreach lectures	Lancaster School for Girls	Years 8, 9 and 10 + Post 16 students	Around 350

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Title	Location	Audience Category	How Many Participants
29/06/2006	SEAS Celebration (Setpoint Gloucs)	Bishops Cleeve School Gloucs		
29/06/2006	University Open Day	School of Chemistry		
04/07/2006	Climate Change Lectures	Cotham School, Bristol	Year 9 students	
	Sutton Trust Summer School Chemistry Component (2 days)			
07/07/2006	School Technicians' Conference		Technicians from the region.	Over 45
	Chem@rt Presentations	various		
08/07/2006	VIP Summer School	School of Chemistry	Visually impaired people	
	Higher Education Summer School	School of Chemistry	Secondary	Nearly 60
12/07/2006	Perfume Chemistry Workshop	University of Bristol Biochemistry laboratory	Year 10 students	24
17/07/2006	Inaugural Year 12-13 Joint Chemistry Summer School Between the Schools of Chemistry at Bristol University and Trinity College Dublin	Bristol and Dublin	Years 12 and 13	16
21/07/2006	School visit	Sheldon School, Chippenham	Year 10	40
24/07/2006	NAGTY Summer School	Biochemistry University of Bristol/School of Chemistry		
25/07/2006	The National Academy for Gifted and Talented Youth (NAGTY) two Week Summer School 2005	School of Chemistry	Secondary	20
07/08/2006	Mackay North SHS	Queensland Australia	Teachers, year 9	
31/08/2006	8th European Conference on Research into Chemical Education (ECRICE)	Budapest		
01/09/2006	Spectroscopy Tours	School of Chemistry	A-Levels	

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Title	Location	Audience Category	How Many Participants
08/09/2006	The BA's Festival of Science Lecture "The Chemistry of the Atmosphere"	UEA	KS4 and Post 16.	139 students, 1 adult
12/09/2006	Spectroscopy Visits		Year 13	Around 500 and their teachers
14/09/2006	Video conferencing lecture Lecture for Bedford School		6th formers	
26/09/2006	Talk on Atmospheric Chemistry to DETAILS	Pates Grammar School	6th formers	
27/09/2006	Perfume Chemistry Conference		Year 11	32 + an audience of 120+ students, teachers and pa
04/10/2006	Atmospheric Chemistry Lecture	Marlwood School, Thornbury		60 students, their parents and members of the publ
11/10/2006	Lectures and talks	Wuhan University High School, Central China	International students	100
24/10/2006	Influencing the Future: A Level Chemistry	National Science Learning Centre, York		
27/10/2006	Chem@rt Winners' Day	Explore-at-Bristol		
03/11/2006	Year 6 workshop day	Westbury Park Primary School	Primary	2 classes plus full school assembly
06/11/2006	6 November: Lecture Demonstration for Local Scouts and Cub Groups	School of Chemistry	Scouts and Cubs from the Avon County area	320
10/11/2006	Input into programme development with a tv company Tigress Productions	Tigress Productions Offices		
11/11/2006	ASE West of England Region Meeting	University of Bath		

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Title	Location	Audience Category	How Many Participants
14/11/2006	'The Chemistry of a Saturday Night' - Fusion Lecture	School of Chemistry	Undergraduates, postgraduates and academic staff	Around 220
15/11/2006	Schools' Chemistry Conference	School of Chemistry	Students and teachers from 9 schools	Around 340
16/11/2006	Primary School Visit	Staunton and Corse Church of England	Years 5 and 6	
20/11/2006	Chemistry Awareness Afternoon	Clevedon School	Students in Years 11 and 12	Around 40
21/11/2006	Primary Science Day	Robinswood Primary School, Gloucester		
22/11/2006	Primary School Assembly and Workshops	Henleaze Junior School, Bristol	three groups of Year 5 students	
28/11/2006	Primary School Assembly and Workshops	Shirehampton Primary School, Bristol	Years 2 and 6	around 330
29/11/2006	"Are We Losing our Cool?" Workshop	Queen Elizabeth Grammar School, Norfolk		30
02/12/2006	"Are We Losing our Cool?" Workshop	St Johns University, York	students aged between 12 and 16	16
06/12/2006	6 December: University of Bristol Schools' Christmas Lecture	University of Bristol	Schools from the City of Bristol	
11/12/2006	Spectroscopy Visits	School of Chemistry		
13/12/2006	Climate Change/Atmospheric Chemistry Update for Teachers	School of Chemistry	Secondary school teachers	
14/12/2006	Spectroscopy Visits	School of Chemistry		
11/01/2007	Primary Science Day	Winchcombe Abbey Church of England Primary School, Gloucestershire	Years 6 and 7	
12/01/2007	'Climate Change - How to Keep Our Cool'	Brunel University London	Year 10 Gifted and Talented students	40

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Title	Location	Audience Category	How Many Participants
29/01/2007	Workshops	Thomas Hardy School, Dorset	Post 16 students and their teachers	
30/01/2007	Lecture demo 'A Pollutant's Tale'	Ribston Hall High School, Gloucester	Gifted and Talented students from Years 8-13	over 50
01/02/2007	Lecture demonstration 'A Pollutant's Tale'	Cheltenham College, Gloucestershire	senior college students	
07/02/2007	Stroud High Science Day	Stroud High School	secondary	600

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Presentations

Date	Location	Title	Description
02/03/2005	Millenium Gloucester Conference Centre, Gloucester Road, London	CETLs Network Event	
16/05/2005	School of Chemistry	Bristol ChemLabS Stakeholders Conference	Presentations about Bristol ChemLabS and workshops.
11/10/2005	University of Bristol	University of Bristol eLearning Advisors Network (eLAN) meeting	Presentation about the DLM by Dr Norman
27/10/2005	School of Chemistry, University of Leeds	One-day informal visit	Tour of their new teaching lab facility and Bristol ChemLabS promotional items giveaway.
29/10/2005	University of Bristol	Two week intensive laboratory course inspired other science departments	Feedback received from Gill Clarke (Head of Teaching Support Unit) during the first Bristol ChemLabS Management Board meeting.
14/11/2005	Graduate University of Bristol Graduate School of Education	eLearning Consultation Event	Consultation by The Learning Technology Support Service (LTSS) in collaboration with eLan (The Academic e-Learning Advisers Network) of users of new technology for teaching, assessment or student support.
28/11/2005	Science Museum, London	Launch of 'Shape the Future'	National launch of a campaign to promote engineering and technology to young people, featuring three Rednock School students working on "Climate in the Classroom", who were asked to present their work

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Location	Title	Description
14/12/2005	University of Bristol	LTSS and Teaching Support Unit event: 'Annual Promoting Learning and Teaching Excellence and Innovation at the University of Bristol'	Presentation of some preliminary DLM work by Dr D Smith and Mr J Eastman, presentation of prizes including to two winners from the School of Chemistry.
26/01/2006	University of Bristol	Presentation about Bristol ChemLabS	Given at the School of Chemistry Industrial Advisory Board
02/02/2006	Salter's Institute, London	Presentation by Nick Norman	Presentation about Bristol ChemLabS at CEG seminar called "The changing nature of university courses in chemistry and chemical engineering". The Seminar focused on the changing nature of university courses in Chemistry and Chemical Engineering. Data was presented by both the RSC and IChemE and was then followed by contrasting case studies from 4 universities. The audience consisted of people from government, education, academia and industry.
24/03/2006	School of Chemistry	Bristol ChemLabS 1st Anniversary Reception	A celebration of the considerable achievements so far, and to thank people involved for their support and the work they have put in to making Bristol ChemLabS such a success.
18/10/2006	Nottingham Trent University	Outreach in Collaboration	CELS held this one day meeting to support and encourage those wishing to enhance and develop their portfolio of outreach activities, where delegates described and/or demonstrated the resources available in their subject and met like-minded practitioners to discuss common issues and plan future collaborative ventures.

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Date	Location	Title	Description
21/11/2006	School of Chemistry	Bristol ChemLabS and the DLM - What Will it Mean for Me?	Bristol ChemLabS presentation to School of Chemistry staff and postgraduates
09/01/2007	SoC	Overview of Bristol ChemLabS CETL	Presentation as part of the 2007 Learning and Teaching Week at the University of Bristol
01/02/2007	Salter's Institute, London	Presentation by David Smith: Smarter Use of Existing Laboratory Facilities	<p>The Seminar, entitled "Sustaining Chemistry in Higher Education", focussed on the Royal Society of Chemistry's Chemistry for our Future Project, and mainly how they are planning to enhance the understanding between school and university chemistry and smooth the transition to higher education.</p> <p>The audience consisted of people from government, education, academia and industry.</p> <p>A report on the findings of the Seminar will be published in due course.</p>

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Publications

Date	Publication	Author	Description
03/03/2006	Science in School Issue 1 Spring 2006	Tim Harrison	Review of the documentary "Nano: the Next Dimension"
	Science in School Issue 1 Spring 2006	Tim Harrison	Review of John Emsley's textbook "The Elements of Murder: a History of Poison"
01/04/2006	Interact Issue 32 April 2006	DMS	Article by David Smith about Bristol ChemLabS (more details?)
28/07/2006	Science in School Issue 2 Summer 2006	Tim Harrison	Review of GlaxoSmithKline's "The Science Behind Medicines"
23/10/2006	The House Magazine Vol 31 23 October 2006	David Smith	Advertorial for the AIMS and Bristol ChemLabS CETLs in the House of Commons' magazine headlined "Leading the field in teaching science and medicine" featuring images of primary and secondary school students engaged in Bristol ChemLabS Outreach activities.
01/11/2006	Chemistry Review Vol 16 Number 2 November 2006	Tim Harrison	Article about perfume chemistry
21/12/2006	Science in School Winter 2006 Issue 3	Tim Harrison/Dudley Shallcross	Article about Bristol ChemLabS Outreach activities

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Publicity

Publication	Description
Higher Education & Research Opportunities (HERO) Website 26 January 2005	Announcement of HEFCE funding for Bristol ChemLabS and AIMS
Guardian Unlimited 27 January 2005	Announcement of HEFCE funding for Bristol ChemLabS
Bristol Evening Post 28 January 2005	Announcement of HEFCE funding for Bristol ChemLabS
BBC News Website	Announcement of HEFCE funding for Bristol ChemLabS
Bristol Evening Post 12 February 2005	Announcement of HEFCE funding for Bristol ChemLabS
Education in Chemistry March 2005	Article about HEFCE funding for Bristol ChemLabS and Nottingham Trent University
Education in Chemistry March 2005	Article about the two 2004 Higher Education Academy National Teaching Fellowship, one of which (Rising Star) went to Dudley Shallcross.
RSC News April 2005	Announcement of HEFCE funding for Bristol ChemLabS and Nottingham Trent University
BBC News website	Story on Bristol ChemLabS and the the first Stakeholders' Conference
Higher Education & Research Opportunities (HERO) Website 18 May 2005	Article about the first Bristol ChemLabS Stakeholders Conference
Times Higher Education Supplement 20 May 2005	Article about a University of Bristol community project involving Dudley Shallcross
scotsman.com	Announcement of HEFCE funding for Bristol ChemLabS
University Website 23 June 2005	Article about Dudley Shallcross and Tim Harrison receiving RSC Awards from Tony Blair
Higher Education & Research Opportunities (HERO) Website 26 June 2005	Article about Dudley Shallcross and Tim Harrison receiving Awards from Tony Blair
Higher Education & Research Opportunities (HERO) Website 06 July 2005	Article about the summer school for visually impaired students aged 20 to 80+

Appendix 3: Tables of Bristol ChemLabS Events, Activities and Publications

Publication	Description
Dursley Gazette 29 July 2005	Article about Rednock students spending a week trialling new chemistry practicals at the School of Chemistry
University of Bath Website 08 August 2005	Article mentioning the Bristol ChemLabS NAGTY summer school
Specialist Schools and Academies Trust website 31 August 2005	Case study of the relationship between the School of Chemistry and Rednock School
University News September 2005	Tim Harrison, Dudley Shallcross and one of the students from the 2005 NAGTY summer School on the front cover and article about Dudley Shallcross and Tim Harrison receiving RSC Teacher of the Year Awards from Tony Blair.
Education in Chemistry September 2005	Article about the Bristol ChemLabS summer school for visually impaired students
Education in Chemistry September 2005	Article including biography of Tim Harrison and mention of Dudley Shallcross' HE Teaching Award and the Parliament ceremony.
Dursley Gazette 01 September 2005	Article about Rednock students winning regional heats of the 2005 Express Yourself competition.
BA e-Newsletter Issue 4 September 2005	Article about the NAGTY Summer School held at the School of Chemistry
University News 01 October 2005	Article about Rednock students winning the South West regional final of the Express Yourself conference in July
Higher Education & Research Opportunities (HERO) Website 25 October 2005	Article about series of free public lunchtime talks offered by University of Bristol staff including Dudley Shallcross.
Gloucestershire Gazette 16 November 2005	Article about Tim Harrison's appointment as Bristol ChemLabS School Teacher Fellow.
Dursley Gazette 01 December 2005	Article about Rednock students representing the BA at the national launch of the Shape the Future Campaign.
Education in chemistry January 2006	Article about Chemistry week featuring two photos from Bristol ChemLabS Outreach activities.

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Publication	Description
Wiltshire Gazette 09 February 2006	Article about WISE event run at Malmesbury school in conjunction with Loughborough University
Dursley Gazette 10 March 2006	Article about Rednock School getting a grant aimed at promoting science among girls to run Tim Harrison's perfume workshop.
Dursley Gazette 05 May 2006	Article about Kingswood Primary School visit
Stroud High School's website 15 May 2006	Press release about Perfume Chemistry workshop in May involving year 10 students from Stroud High and Winchcombe
Physics Education Volume 41, Number 4, July 2006	Article about Perfume Chemistry workshop in May 06 involving Marlwood and Rednock schools
Primary Science Review 94, September/October 2006	Article about Bristol ChemLabS Outreach for primary schools
Young people's programme e-newsletter Issue 8 September 2006	Article about perfume chemistry workshop held in June 2006
University News Webpage 26 October 2006	Article about the Chem@rt 2006 overall winners celebration day
HEFCE News 8 November 2006	Press release titled "HEFCE to provide an additional £75 million to support very high cost and vulnerable science subjects"
Stroud News and Journal 15 November 2006	Article about Chem@rt 2006 Overall Winners
Gloucestershire Echo 15 January 2007	Article titled "Finding the fizz in chemistry day". Includes quotes from pupils, teacher and SEA.

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Visits

Date	Title	Description
12/04/2005	Carole Webb of HEFCE and members of the Swedish National Agency for Higher Education	Tour of the School of Chemistry and discussions of HEFCE CETLs and how the Swedish equivalent of HEFCE might develop a similar programme of their own
16/12/2005	Mr Stephen Williams, MP for Bristol West	Discussion of the aims of the ChemLabS project and the impact that it will have on promoting the teaching of chemistry. The team had the opportunity to demonstrate the important role that Bristol ChemLabS will play in supporting and sustaining the teaching of one of the subject areas that the government has identified as strategically important, yet vulnerable.
08/06/2006	Possible use of Datalogging in the Chemistry department	Meeting between Bristol ChemLabS staff and David Crellin (Abington Partners) to discuss DETAILS
18/09/2006	Meeting with Sarah Jones of ABPI	Meetings to talk about Outreach, meet Bristol ChemLabS executives and take a tour of the School of Chemistry.
20/10/2006	Mr Giles Chichester MEP	Mr Chichester visited Bristol ChemLabS on 20 October as part of an MEP-Scientist pairing scheme organised by the Royal Society.
02/11/2006	US Ambassador to the UK Mr Robert Tuttle	Mr Tuttle visited the University of Bristol 's two CETLs and met members of staff in the Schools of Chemistry and Medical Sciences.
30/01/2007	Study Tour by University of Utrecht	Visit to the School by delegation from the University of Utrecht, presentation about ChemLabS given by DMS.