

Flexible Delivery

An evaluation of the use of the virtual learning environment in higher education across Scotland

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Preface

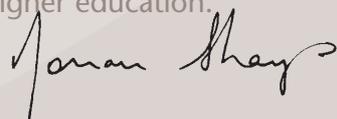
The approach to quality and standards in Scotland is enhancement-led and learner-centred. It was developed through a partnership of the Scottish Funding Council (SFC), Universities Scotland, the National Union of Students in Scotland (NUS Scotland) and the Quality Assurance Agency for Higher Education (QAA) Scotland. The Higher Education Academy has also joined that partnership. The Enhancement Themes are a key element of a five-part framework which has been designed to provide an integrated approach to quality assurance and enhancement, supporting learners and staff at all levels in enhancing higher education in Scotland drawing on developing, innovative practice within the UK and internationally.

The five elements of the framework are:

- a comprehensive programme of subject-level reviews undertaken by the higher education institutions themselves; guidance on internal reviews is published by SFC (www.sfc.ac.uk)
- enhancement-led institutional review (ELIR) run by QAA Scotland (www.qaa.ac.uk/reviews/ELIR)
- improved forms of public information about quality; guidance on the information to be published by higher education institutions is provided by SFC (www.sfc.ac.uk)
- a greater voice for students in institutional quality systems, supported by a national development service - student participation in quality scotland (sparqs) (www.sparqs.org.uk)
- a national programme of Enhancement Themes aimed at developing and sharing good practice to enhance the student learning experience, which are facilitated by QAA Scotland (www.enhancementthemes.ac.uk).

The topics for the Themes are identified through consultation with the sector and implemented by steering committees whose members are drawn from the sector and the student body. The steering committees have the task of developing a programme of development activities, which draw upon national and international good practice. Publications emerging from each Theme are intended to provide important reference points for higher education institutions in the ongoing strategic enhancement of their teaching and learning provision. Full details of each Theme, its steering committee, the range of research and development activities, and the outcomes are published on the Enhancement Themes website (www.enhancementthemes.ac.uk).

To further support the implementation and embedding of a quality enhancement culture within the sector, including taking forward the outcomes of the various Enhancement Themes, a new overarching committee has been established, chaired by Professor Kenneth Miller (Vice-Principal, University of Strathclyde). It has the important dual role of supporting the overall approach of the enhancement themes, including the five-year rolling plan, and of supporting institutional enhancement strategies and management of quality. We very much hope that the new committee, working with the individual topic-based Themes' steering committees, will provide a powerful vehicle for the progression of the enhancement-led approach to quality and standards in Scottish higher education.



Norman Sharp, Director, QAA Scotland

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Introduction

The Flexible Delivery Enhancement Theme

Following its establishment in January 2004, the Enhancement Theme Steering Committee for Flexible Delivery has sought to implement a programme of work which would address the growing challenge faced by higher education institutions (HEIs) to develop and adapt their provision to allow greater flexibility for today's large and diverse student body, as part of the wider implementation of a learner-centred approach.

To this end, the Steering Committee adopted the broadest possible interpretation of flexible delivery, to encompass not only modes of study, but also methods of delivery, together with underpinning support and infrastructure. Accordingly, its programme of work has sought to encapsulate a vision of a learner-centred model of pedagogy and learner support, appropriate to the needs of the individual learner, located within a high-quality learning environment, and supported by efficient and effective business and administrative processes. This work was informed by exemplars of good practice in HEIs worldwide, reflecting changing practice in learning and teaching to promote flexibility, and by the outcomes from a series of workshops involving a number of international experts together with UK and Scottish practitioners.

As a practical means of ensuring that the breadth of the Enhancement Theme was reflected in the scope of its development projects, the Steering Committee formulated a typology of flexible delivery, which comprised the following key operational areas: flexible admissions; credit, recognition of prior informal learning (RPL), accreditation of prior experiential learning; flexible programmes; student support, advice and guidance; continuing professional development (CPD); and collaborative partnerships. This typology provided a framework to support the planning and implementation of a number of projects addressing different practical applications of flexible delivery, the outputs from which would provide a suite of tools to inform and support institutions, practitioners and learners, in taking forward strategic development and practical implementation.

A report on an evaluation of the use of the virtual learning environment in higher education across Scotland

This is the second of a series of publications from the Flexible Delivery Enhancement Theme. It represents the outcomes from one of six development projects supported by the Steering Committee.

Recognising the integral and growing role played by the virtual learning environment (VLE) in the flexible delivery of higher education (HE), this publication aims to

- identify patterns of VLE use, and common experiences of a positive or negative nature
- develop an overview of this aspect of flexible delivery in the Scottish HE context, to enable benchmarking by individual users, teachers, managers and other stakeholders
- contribute to the sum of knowledge and best practice in VLE development in the Scottish HE sector, identifying norms and trends and, where possible, to inform future investment in learning technology.

Other publications from this Enhancement Theme

Other publications from this Enhancement Theme will address different dimensions of flexible delivery, including: flexible entry and flexible programmes, with a focus on RPL and credit transfer in the context of the Scottish Credit and Qualifications Framework (SCQF) and curriculum design for achieving learning outcomes by a variety of different routes and modes of assessment; and the strategic planning and implementation of flexible programmes, with a particular focus on blended learning. The compilation of an on-line resource to facilitate access to information, tools and materials from Joint Information Systems Committee (JISC) development programmes, and from the work of the Higher Education Academy, will further assist institutions in enhancing flexible delivery within the context of their individual missions.

Contributors

Project Director and author of report:	Professor Geoffrey Ward, formerly Deputy Principal, University of Dundee
Questionnaire preparation and analysis:	David J Walker, Learning Technologist, Learning Enhancement Unit (LEU), Centre for Learning and Teaching, University of Dundee
Case Study 1:	Dr Linda Morris, Teaching Fellow, Life Sciences Teaching Unit (LSTU), University of Dundee David J Walker, Learning Technologist, Learning Enhancement Unit (LEU), Centre for Learning and Teaching, University of Dundee
Case Study 2:	Professor Phillip John, Department of Chemistry, Heriot Watt University

Chapter 1: A report on an evaluation of the use of the virtual learning environment in higher education across Scotland

Professor G C Ward MA FFCS FRSA Miod, formerly Deputy Principal, University of Dundee

Background

Scotland has 13 universities, one university college, two colleges of HE, two art schools, one conservatoire, an Open University presence and the Scottish Agricultural College. The Scottish colleges (formerly known as colleges of further education (FE)) articulate in varying degrees with the provision of HE in their regions. Articulation agreements may gain a new impetus from the recent merger of the funding councils for HE and FE into a single body, the Scottish Funding Council (SFC). In addition to offering full-time and part-time degrees, institutions of HE offer short courses, distance learning, CPD and a variety of other learning and training opportunities that contribute significantly to lifelong learning. (For further information on HE in Scotland, including research and commercialisation, knowledge transfer, widening access and funding, go to <http://www.universities-scotland.ac.uk>).

The environment in which Scottish HEIs conduct their business is competitive regionally, nationally and internationally, and subject to rapid change. Universities, particularly those in an urban setting, have assumed a new civic prominence, as traditional employment opportunities in manufacturing and other industrial sectors have fallen away. Universities are major custodians of, as well as stakeholders in, the knowledge economy, and create jobs downstream as well as being major employers. For example, in Dundee, the fourth largest city in Scotland, there are 21,000 students in full-time tertiary education, and the University of Dundee contributes between £280 million and £300 million to the local economy. Scotland has already attained the participation rates by young people in HE that England has set as a target. The importance of students as a linchpin in local economies and the enhanced civic prominence of universities as employers has led to an increased role in cultural planning and a heightened emphasis on cultural planning itself as broker between the varied needs and aspirations of city workers, residents and visitors. (For a more detailed investigation of these themes, funded in part by the Scottish Executive, see Lia Ghilardi, *Culture at the Centre: Cultural Planning, A Strategic Approach to Successful and Sustainable Community-Based Regeneration in Scotland*, National Cultural Planning Steering Group, November 2005).

For the institution itself, the nature of study has changed radically. The traditional model of participation in HE, whereby a student resides for a discrete period of essentially unbroken study, typically for four years, moving on to employment and thereby terminating his or her relationship with the institution, is becoming far less common. Students need casual employment in order to meet the costs of study. Degree programmes are modular, implying a collage of learning and the attainment of qualifications, which advances by progressive accumulation, which can be interrupted and resumed and which, in the case of Scotland, can be measured against the SCQF. This is arguably the most sophisticated HE qualifications framework in Europe, and is well attuned to European drivers for change such as the Bologna process (See <http://www.scqf.org.uk/>).

These change processes both find expression through and are contextualised by an unprecedented and accelerating phase of technological change, whose emblems are the internet and the personal computer (PC).

Learning technology

Until the 1990s, knowledge was print-based. All university teachers and researchers relied on books and journals, while some, chiefly in the sciences, required access to computers. That situation has effectively reversed, becoming one where the PC is ubiquitous, and where the search engine, for instance Google, rather than the library, is the first point of reference in a student's search for knowledge. HEIs admit students habituated from childhood to the PC on the kitchen table; who are conversant in the varied - or even simultaneous - use of the PC for gaming, shopping and entertainment alongside study; and who will leave the institution to find employment in a world where information technology (IT)-literacy is a *sine qua non*. It follows that HEIs would be failing in their mission if those realities of pre- and post-student life were not recognised explicitly, and appropriate training supplied.

The VLE

The VLE has become crucial to this training. More importantly, it is in process of becoming central to the mass delivery of HE. As a tool of the institution, it has the potential to reflect cultural change and the diverse needs of students at the point of academic delivery, while stabilising the eclectic and untrustworthy aspects of internet-based data. Moving from the campus back to the kitchen table at home, the VLE enables remote and self-paced study. Thus, a convergence between the traditionally separate groups of distance and on-campus learners is forming around self-paced blended learning (ie a balanced mixture of solitary computer-based and face-to-face study). The side effects alone of this convergence are of historical and cultural significance. For example, in all likelihood, the current student population is witnessing the demise of the lecture as a staple of learning. The VLE permits repeated attempts at mastering the same information, somewhat in the manner of the hierarchisation of levels of increasing difficulty in a PC game. This is not a trivial point. The one-off event of a lecture in real time is of course advantageous, to a limited but real degree, in terms of human interaction. But if that learning event can be repeated infinitely on-line, the loss of face-to-face contact may be more than outweighed by the potential for incremental, demonstrable learning, a process aided further by the growing use in HE of computer-aided assessment. When face-to-face contact between student and tutor does take place, it can then be reserved for a more nuanced and definite purpose, within the learning outcome, leading to savings in staff time and an objectively demonstrable improvement in the learning experience, including raised levels of attainment. This theme is taken up by Dr Linda Morris and David Walker, in the Dundee case study that appears as Chapter 3 of this publication, and is the key finding of this exercise. Previous surveys of VLE use, for example, *Managed Learning Environment Activity in Further and Higher Education* in the UK (JISC/Universities and Colleges Information Systems Association, 2003) have monitored take-up, without being able to advance to an assessment of the quality and measurable gains of e-learning and flexible delivery.

The survey of VLE use in HE across Scotland

The survey was sent to heads of e-learning, or equivalent heads of learning technology support, plus other individuals with known responsibility for the uptake of the VLE in their institution.

1 Aims

The aims of the survey were, first, to identify the degree of VLE take-up across the institutions. Secondly, the survey sought to identify the particular VLE chosen, for example, Blackboard, WebCT or other virtual environment(s), commercially available or bespoke. The third area of analysis was more diverse, and attempted to elicit, among other things, the degree of satisfaction with the VLE chosen; the patterns of use and the depth of competent deployment among the academic and student communities; the associated tools and technologies which were thought to be key; and perhaps most tellingly, the drivers for change in this adoption of learning technology.

2 Basic findings

All respondents indicated that:

- their institution had, or was in process of acquiring, a VLE.

Many respondents indicated that:

- there is a preference for commercial solutions, eg Blackboard
- financial constraints influenced choice
- VLE development would be influenced by tie-ins with products already acquired, and agreements already signed
- a high percentage (76 per cent across the HEIs) of courses are VLE-supported, and that this is rising
- on-line assessment, peer group support and discussion fora are now identified as key
- institutional support for the VLE in the form of strategy documents and senior management encouragement have significant impact.

3 Conclusions

Readers of the survey will draw their own conclusions from its answers. Drawing together the implications across different questions, the following arguments come readily to mind.

The VLE is rapidly becoming a cornerstone in the provision of course materials. The high percentage of courses 'badged' as VLE-supported inevitably disguises an uneven terrain, in terms of what might be thought inventive, or indolent, placing of course materials on the VLE. Where it is misused as one more dumping ground for inert textual material in an already information-saturated environment, it will clearly offer a poor service to its users. Here staff development is key, with the respondents to the survey indicating a preference for individually oriented training in VLE use.

If the high percentage of courses that are VLE supported is read alongside the response to Question 20 (as to whether each institution has a campus-wide policy to encourage VLE use), the result is suggestive; 54.5 per cent of respondents report such a policy, but a significant minority (36.4 per cent) do not. It may be deduced from this that **VLE uptake is largely student led, rather than being**

driven by strategy or policy. This was confirmed anecdotally by discussion following the analysis of the questionnaire. However, it is rendered less certain by the response to Question 21, which seeks to identify the drivers for VLE adoption across the institution, where staff champions, strategic aim and technology itself are cited as drivers.

Some of the later questions in the survey locate the VLE as part of a varied technological palette, one that would also include wireless technology, laptop borrowing schemes, e-portfolios and so on. Here the patterns of adoption and statements of desiderata are variable, suggesting perhaps that while such innovations are subject to financial constraint, they are also malleable, to some extent, within a particular institutional strategy, culture or brand.

The answers on take-up of the VLE may be read in conjunction with those relating to financial constraint, strategy and tie-ins with particular companies. Clearly, the VLE is here to stay; or rather, it is here to change, not simply keeping pace with what technology can perform, but mediated by the particular products of companies such as Blackboard with whom HEIs have entered into agreements. (The fact that Blackboard merged with WebCT the day after the questionnaires were emailed, with subsequent developments that have yet to show a resolution of that situation, signals how vulnerable to factors beyond their control, and to the general pace of change, the purchasers of the product may be). Anecdotally, follow-up conversations included an element of speculation that relationships with commercial suppliers might be long-lasting but ultimately transient, and replaced by in-house provision of solutions. Conversely, the possible outsourcing of IT provision arose as a possible future direction in the longer term.

In sum, the VLE is set to increase the importance and dimensions of its place in the flexible delivery of HE. It will inevitably become more sophisticated in both the student-led demands on it, and in what it can provide. A wider shift to web-based services will only intensify this. A relative newcomer to the traditional cut-and-thrust of resource allocation and the rest of institutional administration, it is in rapid transition from being regarded as an adornment to being acknowledged as one of the foundations of core business. The inevitable rise in investments and costs will need to be acknowledged by both senior management teams, and by the SFC.

Acknowledgements

I would like to thank David Walker (University of Dundee) for his assistance in preparing and analysing the questionnaire; Prof Phillip John, (Heriot-Watt University) Dr Linda Morris (University of Dundee) and David Walker again, for their work in preparing case studies; Dr Richard Parsons (University of Dundee) for his ability to see into the future; Ms Judith Smith, Director of E-Learning at The Robert Gordon University for her early involvement in the project; Dr Sarah Knight and Ms Lou McGill of the JISC for further information; the Enhancement Themes Flexible Delivery Steering Group for collective wisdom and particular pointers, and above all Miss Thelma Barron of QAA Scotland, for her endless patience and forbearance.

Chapter 2: Evaluation of virtual learning environments in higher education sector (Scotland)

David Walker, Learning Technologist, LEU, Centre for Learning and Teaching, University of Dundee

A copy of the questionnaire can be found in the Appendix to this publication and it is also available on-line at <http://www.dundee.ac.uk/learning/dol/qaavle.htm>

Question 1: Please state your institution and position within your institution.

Institution	Role
Glasgow Caledonian University	Pro Vice-Chancellor
University of Aberdeen	Learning Technology Manager
Scottish Agricultural College	Flexible Learning Manager
University of Paisley	Director of Centre for Learning and Teaching
Napier University, Edinburgh	Director, Educational Development
Glasgow School of Art	Head of IT
University of Dundee	Director of eLearning
Open University	Learning & Teaching Coordinator
University of Edinburgh	E-Learning Manager
The Robert Gordon University	Deputy Director of the Department of eLearning
University of St Andrews	Learning Technology Consultant

Question 2: How long have you held this position within your institution?

Time in position (years)	Number of respondents	% of total respondents
One year or less	2	18.2%
Two years	3	27.3%
Three years	1	9.1%
Four years or more	5	45.4%

Figure 2.1: Respondent time in current position within institution (years)



Question 3: Does your institution have a VLE that meets the following definition? 'An online learning environment which delivers some or all of a module or programme/course for your student population.'

Institutional VLE	Number of respondents	% of total respondents
Yes	10	90.9%
No	1	9.1%

Question 4: If you answered 'No' to the previous question, please describe any method by which your institution delivers learning electronically.

- Actually, we have more than one.
- Email, webcams supporting distance learners (intending to procure a VLE within next three months).

Question 5: Which of the following VLEs (if applicable) do you currently use in your institution? *

VLE	Number of respondents
Blackboard Basic	-
Blackboard 6 Basic	-
Blackboard Learning System	2
Blackboard Academic Suite	2
First Class 7.0	1
Learnwise	-
Moodle 1.1	-
Moodle 1.4	-
WebCT 3.8 CE	1
WebCT 4.0 CE	-
WebCT 4.1 CE	2
WebCT Vista 2.1	2

*Please note that one respondent indicated that their institution had two of the VLEs listed. Two respondents did not answer.

Question 6: If the VLE currently in use in your institution was not listed in Question 5 please provide details here.

- Our School of Medicine uses it's own custom built VLE - the MediCAL Resource Centre.
- We are piloting WebCT Vista 4 with a view to full roll out in 2006-07.
- We also use Questionmark Perception (QMP) for on-line assessments and provision of some on-line learning material.
- We have a wide variety of in-house custom-built systems.
- We are migrating to Vista 4, also have a home developed system, EEMeC.
- The Robert Gordon University have an in-house developed VLE platform - RGU, Virtual Campus - developed with ColdFusion.

Question 7: How do you rate the VLE/VLEs in use in your institution on a scale of 1-5 (from a scale of 1, unsatisfactory to 5, highly satisfactory)?

VLE rating	Number of respondents	% of total respondents
1 (Unsatisfactory)	-	-
2	-	-
3	4	36.4%
4	5	45.4%
5 (Highly satisfactory)	-	-
No answer	2	18.2%

Question 8: How long have you been using your current VLE(s)?

VLE use (years)	Number of respondents	% of total respondents
Six months to one year	-	-
Between one year to two years	-	-
Between two years to three years	1	9.1%
Between three years to four years	1	9.1%
Between four years to five years	3	27.3%
Longer than five years	5	45.4%
No answer	1	9.1%

Question 9: Do you feel with hindsight that the choice of VLE in your institution was the right one?

Choice of VLE correct	Number of respondents	% of total respondents
Yes	10	90.9%
No	-	-
No answer	1	9.1%

Question 10: Is your institution contemplating changing your VLE?

Change VLE	Number of respondents	% of total respondents
Yes	2	18.2%
No	8	72.7%
No answer	1	9.1%

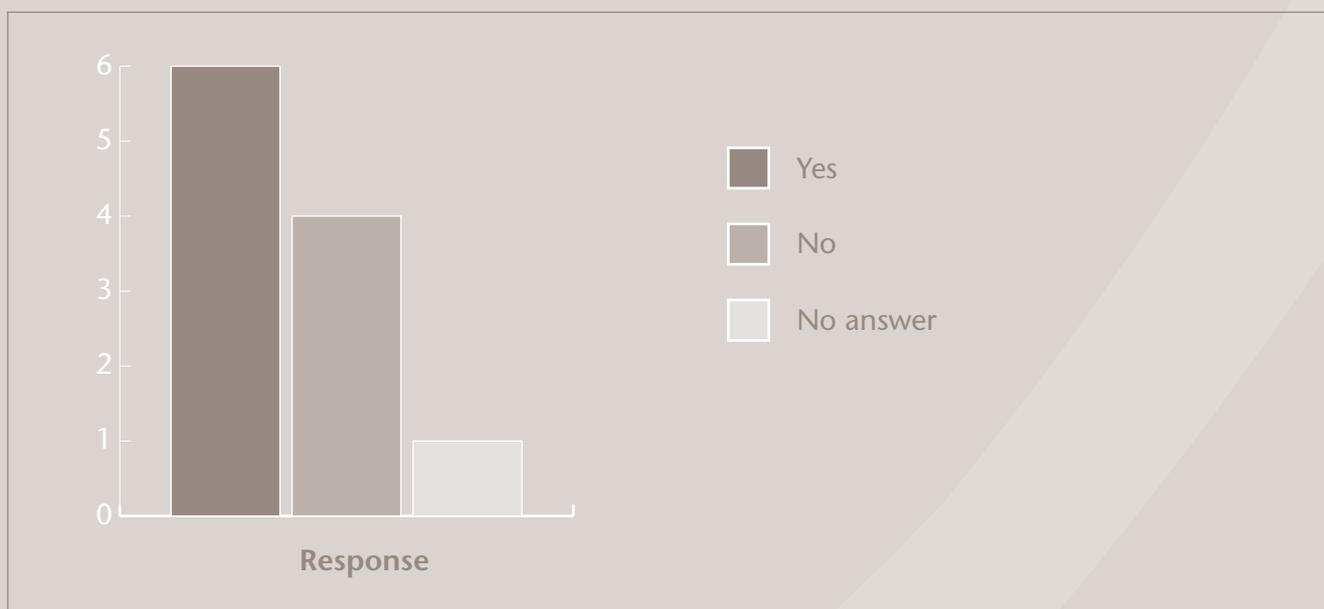
Question 11: If you answered Yes to Question 10, for what reasons are you contemplating changing your VLE?

- We are moving towards a closer integration of the systems already in place, so that there will be a common interface.
- We wish to ensure that we are providing the most suitable tool for our community. Almost any system will have limitations of one sort or another, we periodically review our needs and the options available. If it is sensible educationally to move to a single VLE that could be attractive organisationally.
- An in-house developed platform was right at the time (six years ago) as the choices of platform were then limited. However, we are now conducting a full evaluation and options appraisal to determine what would be the best platform for current and future needs.

Question 12: Is your institution contemplating upgrading your existing VLE?

Upgrade VLE	Number of respondents	% of total respondents
Yes	6	54.5%
No	4	36.4%
No answer	1	9.1%

Figure 2.2: Number of institutions contemplating upgrading their VLE(s)



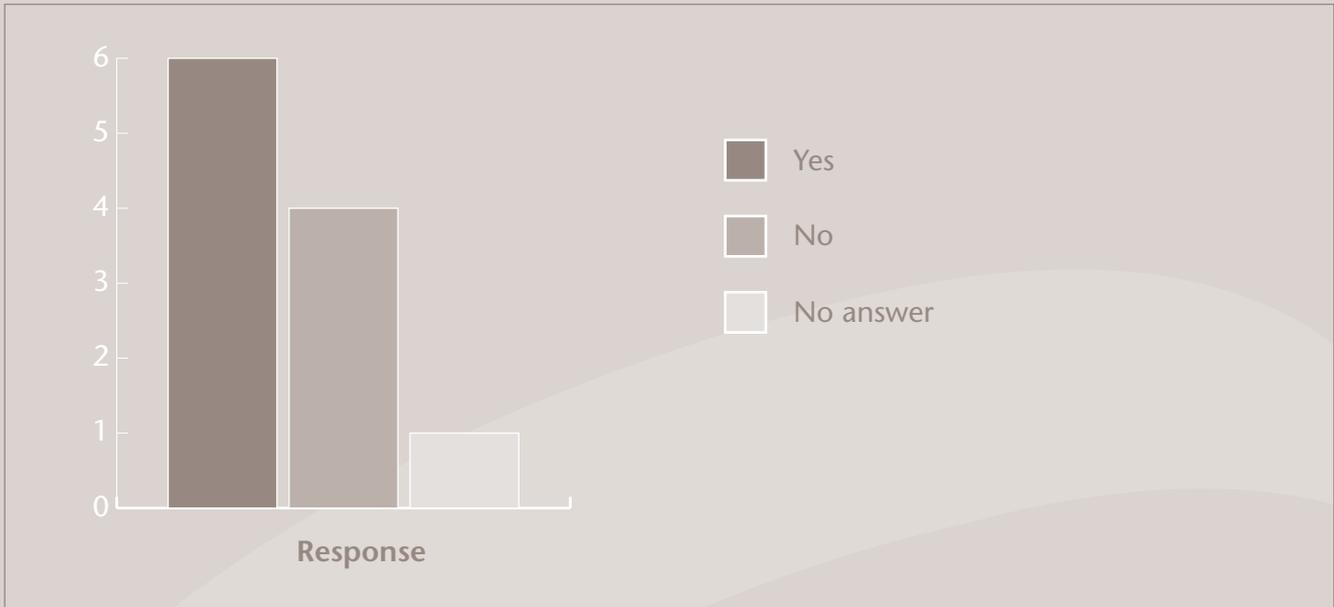
Question 13: Would financial constraints affect your Institutions choice of VLE?

Financial constraints on VLE choice	Number of respondents	% of total respondents
Yes	9	81.8%
No	2	18.2%
No answer	-	-

Question 14: Is your Institution's decision-making regarding future VLE selection influenced by any 'tie-ins' with a product already invested in?

VLE selection influenced	Number of respondents	% of total respondents
Yes	6	54.5%
No	4	36.4%
No answer	1	9.1%

Figure 2.3: Future VLE selection influenced by 'tie-ins' with existing products



Question 15: At what level are you involved in the decision-making in respect of your institution's e-learning?

Level of decision-making	Number of respondents	% of total respondents
Individual responsibility	-	-
Member of a unit/department	2	18.1%
As part of a university-wide group	3	27.3%
Reporting to senior management	3	27.3%
Member of senior-management team	3	27.3%
No answer	-	-

Question 16: To what degree do you feel you are able to personally influence decision-making in respect of your institution's e-learning (on a scale of 1-5, where 1 is minimal)?

VLE rating	Number of respondents	% of total respondents
1 (Minimal)	-	-
2	2	18.2%
3	3	27.3%
4	2	18.2%
5 (Highly Influential)	4	36.3%
No answer	-	-

Question 17a: What percentage of your courses are currently delivered solely or partially over your VLE?

Institution	% of courses delivered via VLE
Glasgow Caledonian University	60%
University of Aberdeen	80%
Scottish Agricultural College	70%
University of Paisley	85%
Napier University, Edinburgh	50%
Glasgow School of Art	-
University of Dundee	90%
Open University	100%
University of Edinburgh	-
The Robert Gordon University	100%
University of St Andrews	33%
Mean	74.22%*

*Mean based on number of responding institutions (9).

Question 17b: What percentage of the courses currently delivered solely or partially over your VLE are delivered to:

Institution	% Undergraduate (on-campus)	% Postgraduate (on-campus)	% CPD	% Undergraduate (distance-learning)	% Postgraduate (distance-learning)
Glasgow Caledonian University	80%	5%	-	10%	5%
University of Aberdeen	75%	10%	5%	5%	5%
Scottish Agricultural College	65%	5%	5%	5%	20%
University of Paisley	80%	85%	-	100%	100%
Napier University, Edinburgh	80%	50%	30%	-	100%
Glasgow School of Art	-	-	-	-	-
University of Dundee	95%	80%	80%	80%	80%
Open University	-	-	-	100%	100%
University of Edinburgh	-	-	-	-	-
The Robert Gordon University	99%	99%	99%	99%	99%
University of St Andrews	95%	2%	-	2%	1%
Mean	83.63%*	42%*	43.8%*	50.13%*	56.67%*

*Mean based on number of responding institutions within each category.

**Question 18: How many student users potentially have access to your VLE?
(standard deviation in parenthesis)**

Institution	VLE student users
Glasgow Caledonian University	15,000
University of Aberdeen	13,000
Scottish Agricultural College	1,000
University of Paisley	9,684
Napier University, Edinburgh	14,000
Glasgow School of Art	1,600
University of Dundee	18,000
Open University	360,000
University of Edinburgh	20,000
The Robert Gordon University	11,500
University of St Andrews	6500
Mean	42,753 (105394.4)
Mean (less OU)	11028 (6408.19)

Question 19a: Do you log your daily 'hits' to your VLE web address?

Log hits to VLE	Number of respondents	% of total respondents
Yes	3	27.3%
No	7	63.6%
No answer	1	9.1%

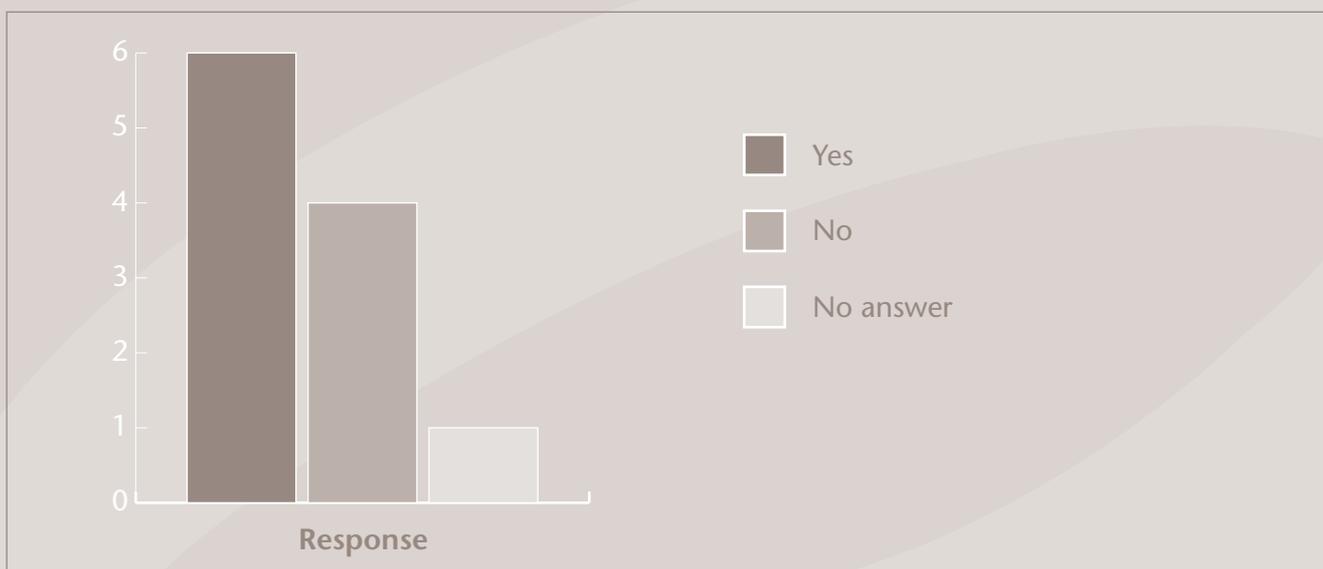
Question 19b: If you log your daily 'hits', how many 'hits' does your VLE receive on a typical day within term-time?

Of the 11 institutions that responded to the questionnaire only one was able to provide details of the number of hits received by their VLE on a typical day within term-time.

Question 20: Does your institution have a campus-wide policy to encourage the use of your VLE/VLEs evenly across all subject areas?

VLE policy (subject)	Number of respondents	% of total respondents
Yes	6	54.5%
No	4	36.4%
No answer	1	9.1%

Figure 2.4: Institutions possessing a policy to encourage the use of VLE(s) evenly across subject areas



Question 21: What drivers influence the use of the VLE/VLEs within your institution (tick all that apply)?

	Strategic aim for institution	Champions amongst staff	Student-led demand	Technology-led developments
Total responses	11 (100%)	11 (100%)	8 (72.7%)	5 (45.4%)

Question 22: Has your institution formalised its e-learning strategy in a policy document?

VLE policy (institutional)	Number of respondents	% of total respondents
Yes	8	72.7%
No	3	27.3%
Don't know	-	-

Figure 2.5: Has your institution formalised its e-learning strategy in a policy document?



Question 23: (Tools) Which of the following do you think are key components of a VLE (tick all that apply)?

Key component (tools)	Total responses
On-line assessment	9 (81.8%)
Library access	7 (63.6%)
Peer group support	10 (90.9%)
Synchronous chat	6 (54.5%)
On-line course application	4 (36.4%)
On-line course enrolment	3 (27.3%)
On-line payment of fees	2 (18.2%)
On-line payment of fines	1 (9.1%)
Audio clips to support content	8 (72.7%)
Video clips to support content	8 (72.7*)
Video-streaming	5 (45.4%)
Simulations	6 (54.5%)
Whiteboards	5 (45.4%)
e-portfolios	5 (45.4%)
Discussion fora	10 (90.9%)
File exchange	9 (81.8%)
Internal email	4 (36.4%)

Question 24: (Tools) Please rate the importance of the following within a VLE.

Key component (tools)	Not needed (total responses)	Relatively unimportant (total responses)	Desirable (total responses)	Essential (total responses)
On-line assessment	-	-	4 (36.4%)	7 (63.6%)
Library access	1 (9.1%)	-	4 (36.4%)	6 (54.5%)
Peer group support	-	-	4 (36.4%)	7 (63.6%)
Synchronous chat	-	2 (18.2%)	6 (54.5%)	3 (27.3%)
On-line course application	3 (27.3%)	3 (27.3%)	2 (18.2%)	3 (27.3%)
On-line course enrolment	3 (27.3%)	3 (27.3%)	2 (18.2%)	3 (27.3%)
On-line payment of fees	4 (36.4%)	2 (18.2%)	3 (27.3%)	2 (18.2%)
On-line payment of fines	4 (36.4%)	3 (27.3%)	3 (27.3%)	-
Audio clips to support content	1 (9.1%)	-	5 (45.4%)	5 (45.4%)
Video clips to support content	1 (9.1%)	-	5 (45.4%)	5 (45.4%)
Video-streaming	1 (9.1%)	1 (9.1%)	5 (45.4%)	4 (36.4%)
Simulations	-	1 (9.1%)	7 (63.6%)	3 (27.3%)
Whiteboards	-	3 (27.3%)	4 (36.4%)	4 (36.4%)
e-portfolios	-	1 (9.1%)	4 (36.4%)	6 (54.5%)
Discussion fora	-	-	1 (9.1%)	10 (90.9%)
File exchange	-	-	4 (36.4%)	7 (63.6%)
Internal email	1 (9.1%)	2 (18.2%)	4 (36.4%)	4 (36.4%)

Question 25: (Technologies) Which of the following do you think are important complementary components of a VLE?

Key component (technologies)	Total no. of respondents
Wireless access	6 (54.5%)
PDA delivery	5 (45.4%)
Mobile phone delivery	4 (36.4%)
External access to university network	9 (81.8%)
Provision of laptops for borrowing	2 (18.2%)
Desktop access	8 (72.7%)
Broadband	8 (72.7%)
International library database search tools	8 (72.7%)

Question 26: (Technologies) How do you rate the importance of the following in the context of your own VLE?

Key component (technologies)	Not needed (total no. of responses)	Relatively unimportant (total no. of responses)	Desirable (total no. of responses)	Essential (total no. of responses)
Wireless access	-	3 (30%)	5 (50%)	2 (20%)
PDA delivery	-	4 (40%)	6 (60%)	-
Mobile phone delivery	-	5 (50%)	5 (50%)	-
External access to university network	1 (10%)	-	-	9 (90%)
Provision of laptops for borrowing	2 (20%)	4 (40%)	4 (40%)	-
Desktop access	1 (10%)	-	-	9 (90%)
Broadband	1 (10%)	-	5 (50%)	4 (40%)
International library database search tools	-	2 (20%)	3 (30%)	5 (50%)

Question 27: (Student training) Which of the following do you think are the key components of training provision in the use of a VLE (tick all that apply)?

Key component (student training)	Total no. of respondents
On-line training	9 (81.8%)
Video-conferencing	1 (9.1%)
Classroom training	7 (63.6%)
Self-directed instruction materials	9 (81.8%)

Question 28: (Student training) How do you rate the following components of training provision in relation to the use of a VLE?

Key component (student training)	Not needed (total no. of responses)	Relatively unimportant (total no. of responses)	Desirable (total no. of responses)	Essential (total no. of responses)
On-line training	2 (18.2%)	-	3 (27.3%)	6 (54.5%)
Video-conferencing	5 (45.4%)	4 (36.4%)	2 (18.2%)	-
Classroom training	2 (18.2%)	1 (9.1%)	3 (27.3%)	5 (45.4%)
Self-directed instruction materials	1 (9.1%)	-	3 (27.3%)	7 (63.6%)

Question 29: (Staff training) Which of the following do you think are the key components of training provision in the use of a VLE (tick all that apply)?

Key component (staff training)	Total no. of respondents
Mandatory training	4 (36.4%)
Group training	9 (81.8%)
Individual training	9 (81.8%)
On-line training	9 (81.8%)
Self-direct instruction	9 (81.8%)

Question 30: (Staff training) How do you rate the importance of the following training methods for the use of a VLE?

Key component (staff training)	Not needed (total no. of responses)	Relatively unimportant (total no. of responses)	Desirable (total no. of responses)	Essential (total no. of responses)
Mandatory training	3 (27.3%)	2 (18.2%)	4 (36.4%)	1 (9.1%)
Group training	-	-	9 (81.8%)	2 (18.2%)
Individual training	1 (9.1%)	-	6 (54.5%)	3 (27.3%)
On-line training	-	-	7 (63.6%)	4 (36.4%)
Self-direct instruction	-	-	4 (36.4%)	7 (63.6%)

Chapter 3: CAA sparks chemical reaction: Integrating CAA into a learning & teaching strategy

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Abstract

This paper will focus on the complete redesign from traditional paper-based assessment to on-line assessment within a first-year course in life sciences and the resulting enhancement in student learning. To contextualise this effectively, however, we will emphasise the important role played by the emergence of a secure, reliable and integrated managed learning environment (MLE); the reassuring presence of dedicated centralised support; and, essentially, the commitment of the course team involved. Integral to the paper will be an analysis of student performance following the completion of the first semester and a comparison of results in relation to the previous method of assessment. We will discuss student reaction to the new scheme and outline the relative merits of the new approach. Finally, we will examine the implications for assessment across the Faculty of Life Sciences in light of the results attained and reveal the plans being formulated for future expansion.

Introduction

At present, the University of Dundee delivers two first-year chemistry modules, which are intended as a foundation course for all students aiming for a degree in life sciences. Consequently, these sequential modules encompass chemical concepts applicable to a number of degrees. The entry qualifications of students registering for these modules range from Standard grade chemistry through to 'A' level chemistry. The course team's aim is to bring all students to an acceptable level of knowledge and understanding for their future study without alienating the more able students. To achieve this, all basic concepts such as molarity; atomic structure; bonding; thermodynamics; kinetics; acid-base equilibria; and organic structure and reactivity are covered, with aspects of each taken beyond 'A' level standard, particularly during the second module. Prior to 2003, the disparity in qualifications made course delivery problematic, resulting in a 73 per cent overall pass rate for the course with weaker students failing to grasp some of the basics of the subject matter and only scraping a pass mark. Clearly change was required.

Background

Commencing in 2002, all lecture notes were made available to students via Blackboard. However, the VLE was not utilised for any further purpose other than posting class announcements. The assessment of each module was divided as follows: eight paper-based tutorials, five practical worksheets with questions and calculations to be filled in plus written mid and end-of-module exams, all marked by hand. A weakness of this system was the lag time between handing in of tutorials and their return - by the time the students had them back the lectures had moved on to other topics. Another drawback of the old tutorial system was highlighted in student comments.

Students reported inconsistencies in marking and in the quality and amount of feedback given for wrong answers. As 10 different members of staff marked these tutorials, these inconsistencies were probably inevitable despite the production of model answers.

It was felt that this system was not giving students, particularly the weaker ones, enough practice in the basics, and they were thus unable to cope with more complex problems in the exams. Additionally, the system of assessment meant that teaching staff were unable to identify which students were struggling until halfway through the module, making the provision of remedial support problematic.

Integration of CAA in course design

The decision to adopt computer-aided assessment (CAA) in some form for all first-year modules was taken at faculty level during 2002-03, thus opening up the possibility of changing the course's whole assessment system and how it was delivered for these modules. In chemistry, after looking closely at QMP and the range of question types available, the decision was made to adopt CAA entirely, and use it for all assessments from September 2003.

The process of preparing the new on-line mode of assessment demanded a significant input in staff effort and time. However, it was felt that the long-term savings in time spent on marking would compensate for this and that the time freed up could then be better spent targeting those students requiring extra tuition. Significantly, concerns relating to the reliability and security of the system were low. The centralised support provided by the University's LEU and the success of previous summative examinations run by the Faculty of Life Sciences and delivered using QMP inspired confidence in both the system and tools at the team's disposal.

Since September 2003, summative and formative on-line assessments have been delivered to students independently from two separate servers. The first is a formative server connected to Blackboard and the second an examination server, which is deliberately independent of all other systems to ensure its integrity. This model enables students to access their on-line formative assessments seamlessly from within the VLE; while higher stakes assessments are delivered securely from a distinct server, using secure browser settings and special Novell exam accounts to log in to the assessment.

Institutionally, ensuring staff confidence in the CAA system was seen as a key factor for success. Hepplestone (2003) discovered that a lack of formal procedures outlining the processes involved in the event of an emergency represented a common misgiving among staff. To alleviate these concerns, contingency plans detailing procedures to follow in the circumstance of computer or server failure were prescribed in the University of Dundee Policy and Procedures on CAA (2003), which were implemented at the start of the academic year. These plans stipulate that a summative assessment will be installed on both the examination server and the formative server although the latter will only be used in the case of unforeseen problems with the examination server.

Technological barriers removed, an assessment strategy was formulated, the focus of which would see a number of 'low-stakes summative' assessments delivered throughout the course of the module via Blackboard. These assessments, although contributing proportionally to the overall module mark, were essentially designed to be formative in nature. It was decided that the lectures, practical assessments and tutorials would be integrated so that the same topics were addressed in all. Crucially, it was also decided to allow multiple attempts at each assessment, apart from the mid and end-of-module exams. Assessments were to be made available for a period of one week each and each student's maximum score achieved during this time recorded and weighted proportionally. It was recognised that this design left open the potential for collaboration between students. However, whilst acknowledging the views of prominent authors such as MacKenzie (2003), it was agreed that it was unnecessary to introduce measures to deal with this eventuality since the objective was to enhance student learning. Further steps were also taken to achieve this, especially the provision of feedback in the event of incorrect answers. Blaney and Freeman (2003) correctly identified that in the case of summative assessment the potential to promote learning through the use of feedback is usually restricted. The authors state that: 'When used for summative assessment, feedback to students is often too late, limited to a single word or number...' (Blaney and Freeman, p. 49).

Accordingly, it was decided at the outset that along with the ability to practise, the students should be provided with detailed and constructive feedback in all but the mid and end-of-module exams. The feedback was designed to point the students towards the correct answer without giving it to them. This assessment strategy made full use of the available technology and was in line with the following view on the focus that assessment should take:

An assessment strategy that focuses on summative evaluation, rather than formative assessment denies students meaningful opportunities for intellectual challenge and growth (Weigel, 2002, p. 13).

Implementation of CAA

The new strategy agreed, the course team began the process of developing the question items and resources that would replace the paper-based approach. The following on-line assessments were produced utilising the full range of question types available via QMP:

- **two practice assessments** - formative, unlimited access - The purpose of these practice assessments was to allow students to familiarise themselves with the new system whilst also allowing teaching staff to assess their knowledge of basic concepts. The students' use of these assessments was monitored closely, both to ensure there were no problems and, more significantly, to gauge their subject knowledge and identify areas, such as use of scientific notation and significant figures, that required some extra input in open workshop sessions
- **five tutorial assessments** - low-stakes summative (3 per cent of overall module mark per assessment) - Tutorial assessments were open for seven days during which time an unlimited number of attempts were allowed. Questions were based on topics covered in the previous two weeks' lectures. Although intended as formative exercises, a small percentage mark was

awarded to encourage students to attempt them, repeat them and reinforce their learning utilising the feedback provided

- **four practical assessments** - low-stakes summative (6 per cent of total module mark per assessment) - Practical assessments were also open for seven days during which time unlimited number of attempts were allowed. Questions related to the results of the lab-based practicals and related lecture material. As with the tutorial assessments these practical assessments had a formative flavour and aimed to improve the students' understanding of the subject area
- **one mid-module exam** - high-stakes summative examination (10 per cent of overall module mark) - This 30-minute invigilated exam consisted of previously unseen questions. The primary function of this exam was to ensure that students were suitably equipped to cope with the on-line end-of-module examination
- **one end-of-module exam** - high-stakes summative examination (40 per cent of overall module mark) - This 50-minute invigilated exam was delivered under stringent invigilation and consisted of previously unseen questions addressing the learning outcomes of the module as a whole.

Prior to each exam all tutorials were 'reopened' in order to allow them to be used for revision purposes. This was found to be very popular with the students who frequently accessed the assessments in preparation for their end-of-module examination.

Student experience

Students were introduced to Blackboard and QMP in an introductory session during which they were given instruction on how to access and complete the assessments. The students were then encouraged to familiarise themselves with the system by completing the two practice tutorials on very basic aspects of chemistry.

Student feedback was collected at the end of the module via the VLE. Out of a class size of 191, 91 responses were received (48 per cent). No negative feedback regarding the use of CAA in the module was recorded. In fact 99 per cent of those who responded said the on-line tutorials improved their understanding of the topics covered and 93 per cent felt that the marks awarded for these were appropriate. Regarding the on-line assessments for the practicals, 90 per cent of respondents said that these improved their understanding and again 99 per cent felt the marks awarded were appropriate. This was in marked contrast to the feedback on the traditional system where the inconsistencies in marking and feedback were the subject of common complaints. A further university-wide survey on e-learning carried out at the University of Dundee amongst students supported these findings (Weyers and Adamson, 2004). The general consensus is that on-line assessments are an excellent learning aid that allowed them to gauge their own progress in relation to a subject. Specifically, the instantaneous feedback provided was found to be an integral part of the assessments and was used constructively in the learning process. As one respondent remarked:

'Computer aided assessment is definitely a good revision and learning tool. It shows where you are going wrong and teaches you to think for yourself, and also shows you the areas that need more revision. It makes things stick in your head for future reference.'

Another respondent's comments endorsed the approach to assessment adopted in the chemistry course. They said:

'The ability to re-do tests and assignments again once you have already done it is good. It enables you to continue learning the more you try it.'

Module pass rates

To assess the effectiveness of the new approach to assessment it was necessary to analyse the respective performance of students during this year and the previous academic year. A comparison of module outcomes revealed that following the introduction of on-line assessment the overall module pass rate rose from 73 per cent to 93 per cent. Significantly, it was found that performance in relation to student results also improved during the mid-module exam.

To determine whether this improvement in performance was due to differences in the entry qualifications of students, it was necessary to research the backgrounds of each cohort and compare their levels of experience in the subject. This analysis indicates that while the entry qualifications in 2003-04 seemed similar to the previous year, the 2003-04 cohort were in fact less well qualified in chemistry than their predecessors on entry to the course. Direct comparison of the mid-module and end-module exam marks of these two years, presented in Table 3.1, reveals a stark difference between the pass rates.

Table 3.1 Comparison of exam marks 2002-03 and 2003-04

Year	Exam	No. of students	No. of questions presented	Average mark (%)	% Pass
2002-03	Mid-module	181	6	59	78
2002-03	End-module	181	6	42	49
2003-04	Mid-module	191	10	70	86
2003-04	End-module	191	17	53	76

The improvement in the end of module pass rate is significant as, in the previous year, there was a drastic drop in pass rate between the mid and end-of-module exam. This was mainly attributed to the fact that for many of the students the topics in the mid-module had been previously covered in their school examinations and only the topics in the latter half of the module were new material. Table 3.2 appears to substantiate this view.

Table 3.2 Student interaction with on-line tutorial assessments

Tutorial	Dates available	No. of students	Total no. of attempts	Average no. of attempts	Average mark (%)
Week 3	03/10/03 - 10/10/03	191	699	3.7	86
Week 5	17/10/03 - 24/10/03	191	677	3.5	76
Week 7	31/10/03 - 07/11/03	191	946	4.95	66
Week 9	14/11/03 - 21/11/03	191	802	4.2	58
Week 11	28/11/03 - 05/12/03	191	793	4.1	60

Significantly, the evidence to date suggests that enabling multiple attempts with the purpose of gaining as high a mark as possible has proved highly motivating to the students. The reinforcement of learning through repetition and the feedback provided has helped to bridge the knowledge gap that previously existed. Students are now better equipped to assimilate the new concepts they are introduced to in the latter half of the module and apply this knowledge in the end of module exam.

Conclusion

The enthusiasm of the first-year students towards on-line assessment and the versatility of QMP have encouraged staff to create similar assessments for higher years, although initially for formative purposes only. These were introduced to second and third-year chemistry students in the second semester of 2003-04. As staff familiarity with the assessment software and systems continues to improve, and further evidence is gathered on the effectiveness and efficiencies of on-line assessment, it is envisaged that use in the life sciences will continue to expand. At the modular level, the on-line assessments produced over the previous 12 months now represent valuable reusable learning objects, which, apart from minor improvements over the summer, will be used again for the next cohort beginning in September 2004. To conclude, the adoption of on-line assessment within chemistry has produced a remarkable response. Student engagement with assessment has increased markedly and, more significantly, the poor module pass rate has been successfully addressed with an impressive increase of 20 per cent on the previous year. This achievement would not have been possible had it not been for the hard work, professionalism and adventurous spirit of everyone involved, not least the students. The challenge now is to continue this upward trend in the years ahead.

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Chapter 4: Use of CAA in molecular science 1A September-December 2003

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Students received two practice tutorials to familiarise them with QMP.

They had five tutorial assessments each worth 3 per cent of their module mark. These were available for seven days during which time they had unlimited access. On average each tutorial was accessed 1,000 times (class size 192). Some students had 10 or more attempts at each.

There were also four practical assessments each worth 6 per cent and again open for a limited time with an unlimited number of attempts during that time.

There was also a mid-module and end-of-module exam delivered through QMP.

Molecular Science 1A 2002 (class size 176) used paper-based assessments with 10 paper tutorials, five practical sheets to be filled in, and mid and end-of-module written exams. The tutorials were hand marked by members of staff and returned one week later. They were only done once and many students failed to do them at all. Students had issues with inconsistencies in marking by different members of staff and also differing feedback. The staff-hours involved in the marking of all these paper exercises were considerable.

Direct comparison of the exam marks of these two years gives the following:

Year	Mid-module pass rate	End module pass rate
2002	77%	48%
2003	86%	75%

The improvement in the end-of-module pass rate is significant as there has always been a drastic drop in pass rate between mid and end-of-module. This was mainly attributed to the fact that for many of the students the topics in the mid-module had been previously covered in their school examinations and only the topics in the latter half of the module were new material.

The introduction of QMP has enabled the students to practise problems many times using the instant feedback to point them in the right direction. The types of questions in the exams were the same as had been given in the continuous assessment so were familiar to the students. Previously written exam questions tended to be longer and more complex than most of the tutorial exercises.

From the point of view of a member of the teaching team, QMP has enabled more time to be spent on authoring a wide range of questions to test the students and tutoring those students who can rapidly be identified as being in difficulty rather than marking.

Chapter 5: The SCHOLAR programme in Scotland

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Summary

SCHOLAR is a highly successful e-learning programme, originally developed by Heriot-Watt University for supporting its own undergraduates in science and technology subjects. Now providing learning resources for over 60,000 learners in schools and FE colleges at SCQF levels 6 and 7, it is believed to be the world's largest programme at these levels, and is now being extended into international markets.

SCHOLAR learning resources are designed to support both students and their tutors with an in-built assessment and feedback system that allows students to proceed flexibly at their own pace. Such is the impact of the SCHOLAR learning community, the Scottish Executive has supported its adoption by all 32 education authorities in Scotland as well as private-sector schools. Whilst such support was critical in the formative stages, SCHOLAR is now a sustainable operation with subscription income from the Education Authorities covering the operational expenses. The annual budget is around £1 million covering operational and development income.

The SCHOLAR Forum is a not-for-profit partnership between Heriot-Watt University and the Association of Directors of Education in Scotland (ADES) formed to deliver the SCHOLAR programme. The success of SCHOLAR derives from its partnership model, professional development of teachers in e-pedagogy and the project management approach to developing high quality e-learning content.

On the access front, SCHOLAR is helping to retain students in the traditionally difficult science, technology and now language subjects. It is also helping individual students who might otherwise have been unable to continue their advanced studies or who might have had to drop a subject through ill health.

Background

The SCHOLAR programme is a truly national and, increasingly international, programme of e-learning, bringing to fruition a learning community which bridges schools, FE and HE in Scotland at SCQF levels 6 and 7. It is one of the world's largest e-learning programmes adopted by over 400 secondary schools in Scotland including all the schools in the state sector and the majority in the independent sector. SCHOLAR has developed rapidly into a unique collaboration between HE and the post-compulsory school sector to provide a national educational resource for the core sciences and mathematics. It is the purpose of this article to trace the steps of SCHOLAR from a small initiative to a national programme and illustrate that the integration of quality cycles, evaluation, and using the skills and expertise of pupils and teachers across the web can affect a transformation in educational practice.

More young people than ever before are getting the opportunity to go to college and university. Virtually 50 per cent of those in the 18-30 age range are now entering FE and HE in Scotland. Whilst encouraging, this level of participation is unlikely to suffice for the Scottish science and engineering base. The proportion of school pupils in Scotland studying chemistry, physics and biology at Higher grade exhibited a steady decline between 1993-94 and 2000-01. The challenges are acute if it is to provide the twenty-first-century impetus for economic development and social change.

HE and FE is a national asset and epitomises a technological advanced nation. Its importance has been recognised in providing both personal self-fulfilment and equipping its graduates with the skills the country requires for a knowledge-dominated age. It is paramount to drive forward the economy against increasingly competitive global competition with the skills of its young people.

The UK government and the Scottish Executive have launched a number of initiatives to attempt to stimulate interest by schoolchildren in the sciences with various degrees of success. In many ways the initiatives did not get to the heart of the matter. The close relationships between science teachers and pupils needed nurturing. The teachers required the time to spend enthusing the pupils rather than being weighed down by the perceived drudgery of conventional teaching practice alongside the increasing burdensome administrative and assessment tasks.

The MacFarlane Report (Committee of Scottish University Principals, 1992) generated a debate on the learning environment needed to respond to these needs; echoed by the Dearing Report (National Committee of Inquiry into Higher Education, 1997). Three major challenges were identified:

- curriculum development to create programmes that appeal to these new student groups
- changes in the ways in which students learn and are assessed
- new ways of delivering the curriculum, particularly those using information and communications technology (ICT).

It was against this backdrop and the confluence of ideas that led to the SCHOLAR programme. The University prides itself on being a leading science, engineering and business institution. It required bold academic leadership to invest in its future health and prosperity. It did so, not by adopting well-worn ideas, but by making a financial commitment to develop the SCHOLAR e-learning materials through a strategic open learning initiative.

The further expansion of student numbers in FE and HE implies an increasing diversity of entrants. Particular emphasis of the Scottish Executive policy is placed on recruiting students from disadvantaged backgrounds who are currently under-represented in tertiary education. Participation by young people in post-compulsory education has increased but with a stubborn gap between the social classes. There is a real need to bridge that gap by increasing the participation from talented pupils from poorly performing schools and authorities. It is simply not acceptable that a person with mathematical or scientific ability should be hindered by their postcode. In short, we also need to make sure that access to HE is fair by 'levelling the playing field'.

The SCHOLAR programme in Scotland, whose cumulative income since 2000 exceeds £5 million, is managed through an innovative partnership model - the SCHOLAR Forum. The Forum is a formal partnership between the University and the ADES. The framework for the Forum is consultative and is founded on the precept of fostering a learning community across the educational sectors.

Over the past 10 years, the Heriot-Watt University has developed a leading position in distributed learning and in computer-supported open learning and e-assessment. This expertise provides underpinning research that has resulted in the quality of the learning materials. The SCHOLAR programme built on these foundations and has also developed a pragmatic financial model for the large-scale sustainable delivery that has significantly contributed to educational transformation in Scotland.

Achievement of excellence

It is imperative to provide the vision and share that vision with all the participants irrespective of their role. Through mainly informal means, the SCHOLAR team was driven by the stated goals to:

- give talented young people, irrespective of background, opportunities to excel and achieve their personal academic goals
- encourage the disciplines of mathematics, the sciences and modern languages which have experienced a serious decline over the past decade
- 'level the playing field' in schools, allowing teachers and pupils equal access to high quality learning materials.
- give teachers the flexibility to focus on student learning, rather than the rote delivery of content.
- bring fresh excitement and enthusiasm into teaching through developing professional competencies in teaching science in the modern world.

The first stage was to recognise that the creation of the materials could only be achieved through seconding authors full-time into the project and blending their expertise within a creative environment supported by learning technologists. The authoring teams were experienced teachers and subject specialists seconded full time to the University for the duration of the development phase. At the peak of development, the full authoring team consisted of over 50 individuals, including technology developers. The academic staff that managed the authoring teams for SCHOLAR were fully engaged with developing the e-pedagogy and e-assessment policies throughout and brought that experience back into the University.

But that was insufficient. Academic staff were recruited from each discipline to assume responsibility not only for academic rigour but to deliver the materials against strict deadlines. Teams were therefore established in the original SCHOLAR subjects of biology, chemistry, computing, mathematics and physics and were given the task of producing complete Advanced Higher courses (100 contact hours) for the start of the 2000-01 academic year. We had nailed our colours to the mast and there was no turning back. It was crucial to the credibility of the project, the reputation of

the University and the spur to the authors that the intent was widely advertised amongst the education authorities. The SCHOLAR authoring team knew that the adoption of SCHOLAR depended on the quality of the materials they created.

The programme started as a pilot in 1999 with four education authorities (Edinburgh, Midlothian, East Lothian and the Borders). It grew to roughly half the authorities and then to all the authorities within two years. In practical terms it is delivering complete Scottish Qualifications Agency (SQA) programmes at Higher, Advanced Higher and Higher National to over 400 secondary schools in Scotland within each of the 32 education authorities with high-quality educational materials making full use of the impact and flexibility of web delivery. Our guiding principles are embedded in sound academic pedagogy superimposed on the opportunities afforded by ICT.

The SCHOLAR programme thus required the learning environment to be considered more analytically, much as the McFarland Report recommended some eight years before the start of the initiative. It was helped along this path by the experience of staff in the Institute of Computer Based Learning and operationally through the Learning Technology Centre at the University. In a far-sighted approach, it was recognised that ICT provides a combination of text, graphic, video, audio and communication resources that can be adapted for effective and flexible learning. All that was required was the vision and audacity of the management team of SCHOLAR to believe it could grow from a concept in 1999 through a pilot phase with four authorities to a full national programme in three years.

But to achieve the necessary transformation, more was required than the simple delivery of content, no matter how innovative. An associated CPD programme was developed and delivered across Scotland. The emphasis has changed over the years but always underpinned by the continuously improving e-pedagogical approach. Currently the Forum delivers about 2,500 teacher days per annum of training in e-learning pedagogy and management issues. The greatest challenge to the wide-scale adoption of supported e-learning is not necessarily the technical infrastructure in schools but overcoming the very human reluctance to change. Those teachers and lecturers who have embraced the e-learning approach have recognised the value and support that can be provided to pupils' learning and delight in achievement. We retain the teacher as the central element of pupils' learning combined with flexible learning techniques. We rejected a technology-driven approach to learning in favour of blending the best of both approaches.

That is the reason for the paramount importance we place on the staff development programme, rather than placing emphasis on the technological aspects of e-learning. So in addition to the teaching and learning materials and tools supplied by SCHOLAR, schools in partner local authorities are entitled to participate in a programme of continuing professional development designed to support and encourage the use of the SCHOLAR resource and e-learning in general. Given the resources we have at our disposal, the CPD programme is delivered on a crude model of one teacher per subject per year per school. This provides the rationale for the target of 2,500 teacher days per annum, given there are over 420 secondary schools in Scotland. The programme is phased

through an 'Entry Level' course for teachers who are unsure of their IT skills through to a new course in 2004-05 in the 'Management Issues in e-Learning' aimed at senior managers in schools. The uptake of the latter course testifies to the impact that SCHOLAR is having on the day-to-day operation and planning of e-learning in schools. The courses on offer to classroom teachers are:

- Entry Level
- SCHOLAR in the Classroom
- The SCHOLAR Coordinator
- Managing and Monitoring Learning with SCHOLAR
- SCHOLAR - Supporting Language at Work in French.

These address the pedagogic implications of on-line learning as well as issues specific to the successful implementation of the SCHOLAR resource and utilisation of the ever-growing range of tools available to support the twenty-first-century teacher. These opportunities are all free at the point of use for educational staff in participating schools and authorities. The SCHOLAR Forum is accredited with the GTC National Register of CPD providers. The quality enhancement procedures, monitoring and evaluations demonstrate that the courses are of a consistently high standard and meet, if not exceed, the expectations of the attendees.

Thus SCHOLAR provides an integrated set of materials and educational and administrative services which meet the needs of both students and their teachers. These include:

- comprehensive on-line interactive learning materials (SQA Higher and Advanced Higher) and activities, including assessments and revision packs
- on-line services through our virtual learning environment, which give access to on-line communities, resources, monitoring information and information tools
- printed study guides, distributing to all pupils in Scotland studying the SCHOLAR subjects, containing the text version of the web materials, key reference materials and learning activities
- tutor notes with valuable curriculum and planning information
- organising the annual SCHOLAR conference. Since 2000 this event attracts over 300 delegates from across the education sectors. It was designed to be deliberately inclusive to attract pupils through to Directors of Education, showing the way forward in implementing e-learning pedagogy.
- instigating a national e-tutoring scheme in which pupils across Scotland have access to an experienced tutor in each of the SCHOLAR subjects through an integrated SCHOLAR 'web-board'
- pioneering the development of a similar suite of programmes in European languages starting with Advanced Higher French in 2003-04.

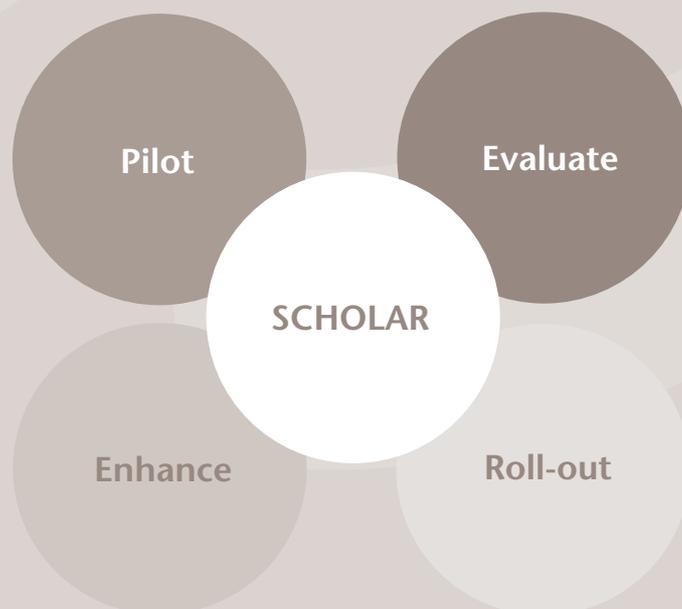
Each was broken down into small topics of around ten student effort hours; sections of which are easily assimilated by the student and consolidated easily into lesson plans. It is acknowledged that most modern pedagogy seeks to engage students in 'active' learning. The SCHOLAR programme has achieved that goal through the design of the content where the student has to take a role in the interactive animations, which permeate the material or proceed via other activities such as assessment. Whilst animations and simulations in science are of proven worth, the expense of their production has limited their use. We have minimised the cost through production savings and shown that the limitation is now the educational value rather than the available resource.

By constructing each course with the same 'look and feel' within the learning environment, the learner is not disadvantaged by poor navigation design. Similarly, the teamwork and associated common guidance on pedagogy produced an internal sharing of good practice as the materials were authored. The subject matter adhered strictly to the learning outcomes and framework documents devised by SQA and the associated guidance notes produced complete and comprehensive courses covering the final two years in secondary schools and the first year at a Scottish university.

Quality circles

The fundamental approach to SCHOLAR development is embodied in Figure 5.1. The process is contained within a circle of pilot, evaluate, roll-out and enhance before the sequence repeats itself.

Figure 5.1

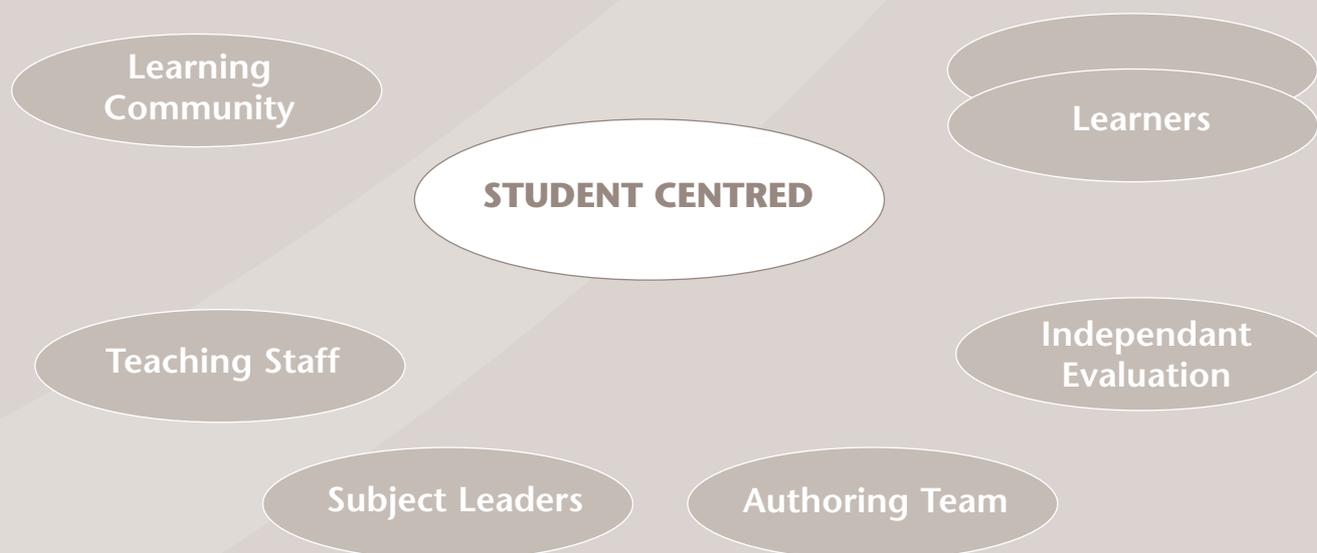


'SCHOLAR Higher chemistry was exceptionally useful. I have prepared most of my lessons for the next month using SCHOLAR as a resource!' Brilliant! Thanks!' Classroom teacher (Lochgelly High School).

This is one of many plaudits for SCHOLAR. The process for producing academically sound and effective teaching material was essentially iterative. The framework for creating, maintaining and improving complete on-line courses is based on assuring quality at each and every stage of the process. Central to this approach is team authoring. Allocation of the individual tasks within each team would be the responsibility of the team and, critically, other members of the team reviewed each other's material. Frequently, the academic member of staff would contribute and occasionally adjudicate on disputed issues. The academic role of the staff member would be to select specialists within each department to review the content. Any subsequent changes would need the agreement of all concerned, testing the diplomatic and management skills of the course leader. Weekly meetings of the entire authoring team were established to share best practice, ensure consistency in approach and raise unresolved educational issues. Fortnightly meetings of the academic leaders over the two-year period were used to manage a complex process, create the climate of mutual cooperation whilst focusing on meeting the approaching deadlines.

Feedback into the teams from the users was just one of the complex web of information rapidly disseminating through the authors, leaders and technologists.

Figure 5.2



Early testing of the material as soon as placed on the web was accomplished through the CPD programmes. Teachers were tasked to review and criticise the available material during the 'hands-on' sessions. The documentation and feedback forms were subsequently distributed to the authoring teams for reflection on the issues raised and asked whether corrective action would be necessary. Tracking changes in such a large programme tested the content management processes of the technologists involved.

During the CPD training, the concept of a 'learning community' was stressed to the teachers. One aspect of this was the ability to make rapid changes to the web content. Procedures were put in place to gather information, errors and suggestions for improvements through a variety of conduits to grow and improve the content through community engagement. Occasionally, resources were assigned to make major improvements to particular courses by responding to syllabus changes or increasing the extent of interactivities.

Reflection and evaluation

Evaluation at key points **throughout** the programme was important to enhancing the quality. Four formal independent evaluations have been carried out:

- SCHOLAR Programme Evaluation, Open Campus Learning Ltd, Glasgow Caledonian University, June 2001
- A Strategic Review of Scotland's E-Learning Capability, Synphonix Ltd on behalf of Scottish Enterprise, June 2001
- Evaluation of Phase Two of the SCHOLAR Programme, The Quality in Education Centre, University of Strathclyde, January 2004
- Learning and Skills Council Report of SCHOLAR in England, March 2005

and these have been invaluable in directing future growth.

The Forum is a self-financing, not-for-profit activity organisation, which needs to be sensitive to the requirements of the learners but also to provide a leadership role in shaping the e-learning agenda in Scotland. Development grants from the Scottish Executive Education Department (SEED) supported the Forum's development in the formative phases. For example, £700,000 was awarded to support the creation of the Forum in 2002. Subsequently £600,000 was granted in 2004 to modify the materials to provide enhanced support and encouragement for independent learning. A further £60,000 was awarded in 2005 to enhance the reporting system, which provided teachers with a detailed overview of class results in the automatically marked assessments and has given them the opportunity to award and moderate marks on-line.

The reports on SCHOLAR have noted the significant impact on pupils, teachers, schools and education authorities. SCHOLAR is perceived as responsible for innovative e-learning in Scotland.

On a personal level the impact on individuals has been important. We have numerous examples of pupils who could not study science or maths without the SCHOLAR resource. Similarly many pupils testify that without SCHOLAR they would have under-performed or discontinued their studies. With the current age profile of teachers of science another major impact has been in revitalising science teachers and science teaching. Many head teachers testify to a new enthusiasm among their science staff. More than 30 students of AH French are the only student in their school studying the subject. Without SCHOLAR they might have had no opportunity to study within a class. With SCHOLAR they are now benefiting from the on-line materials as well as having work set and corrected on-line and are sharing their studies with others in a virtual classroom.

All these reports provided endorsement of its leading position and the Scottish Enterprise strategy - see below - recognised that the programmes were 'a strong driver of Scotland's e-learning market' which resulted in the formation of a 'spin-out' company The Interactive University Ltd to market SCHOLAR globally. The creation of the Interactive University as a not-for-profit company, jointly owned by the University and Scottish Enterprise (the national economic development agency) will enable the global distribution of SCHOLAR.

Joint initiatives

SCHOLAR has led the University into a number of important national educational initiatives. We have worked closely with The Scottish Centre for Research into On-Line Learning and Assessment (SCROLLA) funded by the Scottish Higher Education Funding Council. The Centre has a distributed character with a presence at each of the three directing institutions. SCROLLA provides a focus for multidisciplinary research into the use of ICT in education concentrating on on-line learning and assessment. SCROLLA has a collaborative venture with SQA under the PASSIT programme to deliver the research required to launch e-assessment into national examinations in 2004. The symbiosis of SCHOLAR and PASSIT has enabled the introduction of e-assessment into national examinations faster and more securely than would have been hitherto possible. The SCHOLAR programme has adopted a state-of-the-art assessment engine developed and validated within the University and used in a pilot summative mode by the SQA. In educational terms, an examination may not be any better for being delivered on paper or screen. Assessment and learning must be designed and developed in tandem. The SCHOLAR programme has benefited immensely from the research contributions of the PASSIT team and the practical applications of e-assessment can be achieved on a large scale. The materials were written against a pedagogic model that included 'The SCHOLAR Formative Assessment Policy', a document that is part of the briefing of all new SCHOLAR authors. One consequence of this policy is that the SCHOLAR material, irrespective of the nature of the subject, has formative assessments built in within and at the end of a topic, end of unit and end of course. Since pupils are exposed to and practise this type of formative testing makes the transition to on-line national examinations more attractive: a strategic aim of the SQA.

Innovation and quality

ICT is a powerful aid for teachers to explain difficult concepts, giving access to a huge range of resources within SCHOLAR, and engaging pupils easily. Since 1998 the government has invested over £1 billion creating an ICT infrastructure in schools in the UK, connecting broadband to secondary schools. This investment will only have a dramatic effect if the teachers have confidence they can access high-quality and relevant curriculum content. Electronic whiteboards and data projectors installed in laboratories and science teaching areas, under the control of technically confident teachers, bring new dimensions to whole class teaching. For example, teachers in Scotland are able to project the SCHOLAR materials directly onto a whiteboard and improve the class interaction through personalisation and distributed e-notes. Teachers are finding that the professionally produced graphics and interactivities enliven the class and produce new opportunities for improved classroom practice, ie use of on-line assessments with automatic feedback. Schools are increasingly investing in these types of technology with the confidence of the long-term provision of SCHOLAR.

Distinctive character

We have created a national consultative framework. At its hub is the SCHOLAR Forum Partnership Board, responsible for the financial aspects, and the Academic Policy Board, which has senior representatives from the academic stakeholders and advises on academic strategy. Members comprise senior executives from Learning and Teaching Scotland (LTS), HMI, SQA, ADES and FE Principals. An Advisory Committee is responsible for monitoring the effectiveness of delivery whilst three regional user groups (East, West and North of Scotland) complete the consultative and feedback mechanisms.

In this way SCHOLAR has worked intimately with the main government agencies in Scotland, namely, the SEED, LTS and SQA. Examples of demonstrable outcomes of this approach, linked to national priorities, are:

- The Distance Learning in National Qualifications (OFDL) programme. OFDL is a Learning and Teaching Scotland managed project, financed by the Scottish Executive, to develop a range of learning and teaching electronic resources to support National Qualifications core skills units: communication, numeracy, problem-solving and IT
- collaboration with the Principal Examiners at SQA in analysing, from their annual reports, areas of weakness. With Scottish executive funding we have introduced in 2004 innovative ways of rectifying these problems through a combination of on-line learning materials, learning and revision tools to foster self-reliance and independent learning capabilities in the weaker students
- working with the SQA-sponsored PASSIT programme SCHOLAR has introduced in 2004 a leading-edge personalised 'reporting system' for pupils as part of the e-assessment tools enabling learners to manage their e-learning and supporting their progression. From 2005 the

current teachers' reporting system on student achievement in the assessments will be updated with new funding from the Scottish Executive

- establishing a development through annual subscriptions from the education authorities for updating the material in line with SQA curriculum changes and introducing new subjects in line with national priorities and the revision of the science curriculum in Scotland.

In 2003-04 SCHOLAR undertook a research project financed by the Scottish Executive to identify the management issues in e-learning. The research focused initially on developing good practice in schools. Many exemplars of good practice were revealed and the research also identified the challenges still facing schools in the adoption of e-learning methodology. Eleven whole-school case studies have been published and from them exemplars of pedagogic change were identified. These included:

- effective use of the interactive whiteboard in mathematics
- facilitating independent learning in AH biology
- using SCHOLAR to support a range of teaching strategies in chemistry
- enhanced differentiation, motivation and monitoring in Higher biology.

Impact

The SEED has evaluated the SCHOLAR programme (Evaluation of Phase Two of the SCHOLAR Programme). The findings indicated that SCHOLAR raised the standard of attainment in the nationally important area of the sciences and mathematics and, for the first time, allowed the students to choose the time, place and environment of their learning. Over 85 per cent of the pupils said they used the on-line materials with nearly 70 per cent working up to two hours or more at home.

The evidence suggests that the majority of coordinators, teachers and students have welcomed the provision of SCHOLAR. Seventy-eight per cent of the teachers said they would recommend SCHOLAR to colleagues and 85 per cent of the students said they would recommend it to other students. It has provided teachers with high quality resources to complement traditional classroom teaching approaches.

The evidence suggested that SCHOLAR has raised the students' standard of educational attainment. Overall, the SCHOLAR students performed better in the 2001-02 and 2002-03 SQA examinations compared to non-SCHOLAR students. However, the factors underpinning this finding are more complex than simply being registered with SCHOLAR or not. It is possible that there are important differences in the two groups of students in that the former may have been more motivated to study and the opportunities provided by the programme made this more effective.

The findings suggest that the SCHOLAR programme affected the way students learned. It provided students with an opportunity for greater flexibility in and control of their learning in that they were able to choose to learn in their own time, at their own pace and in their own environment. Some students were able to use SCHOLAR to personalise their learning to meet their own needs and engage in self-regulated learning. Students in schools and colleges used SCHOLAR more than their teachers appreciated; a consequence of the extensive home use of SCHOLAR. From usage statistics it was found that the majority of teachers were not monitoring the students' use of the programme or engaging in follow-up discussions. Thus an opportunity has been missed to date to add depth to the learning experience by creating a bridge between classroom and independent study. On a more positive note, the web statistics provide the evidence to influence the management of the CPD programme to drive home the benefits of reviewing individual's achievements.

Almost half of the coordinators and teachers stated they would like even more staff development. However, it was clear from the analysis of all the data collected that there was blending of established and ICT-based teaching. This gave students the opportunity to make decisions about how they used the range of SCHOLAR materials to support classroom learning. The independent and self-regulated use of the materials by students gave them an opportunity to experience and develop learning strategies that will be useful if they continue into FE and HE. In this way, SCHOLAR may contribute to creating a link between the students' study in their final years at school and their experience in HE.

Future plans

The SCHOLAR Forum is a unique partnership. The consultation and decision-making processes of the Forum ensure genuine participation, ownership and partnership. The SCHOLAR Forum is well placed for long-term and sustained development. The agreement with the education authority members is on a three-year rolling basis ensuring stability, sustainability and the financial resources for further development. A development fund has been established to ensure that ongoing developments and curriculum changes can be financed from Forum resources. Thus new subjects such as information systems, human biology and business management have been added to the SCHOLAR portfolio. The Forum represents an exemplar for delivery of e-learning capitalising on the advantages of flexible learning through web delivery. Its phenomenal growth and uptake by all the education authorities is testimony to the achievement of the ambitious goals and the original concept. SCHOLAR was selected by the Scottish Executive to be 'showcased' at the 2003 Conference of Commonwealth Education Ministers and also at the G8 Summit in Gleneagles in 2005.

Acknowledgements

The author wishes to thank the entire SCHOLAR team who worked selflessly and with great skill and diligence to create the SCHOLAR suite of content and the organisation around it to make an effective contribution to Scottish education.

Chapter 6: Further reading

Surveys

A JISC-commissioned 'Study of Environments to Support E-Learning in UK Further and Higher Education'. Available at http://www.jisc.ac.uk/uploaded_documents/e-learning_survey_2005.pdf
This 2005 survey builds on the 2003 survey referenced in these pages, on 'Managed Learning Environment Activity in Further and Higher Education in the UK'.

Universities and Colleges Information Systems Association surveys may be located at:
http://www.ucisa.ac.uk/groups/tlig/vle/index_html

A Higher Education Training Needs Analysis survey which looked at training needs with regard to the use of learning technology in Scotland specifically can be found at <http://www.htna.org.uk>

There is a link to the Robert Clark Centre for Technological Education Projects at
<http://www.gla.ac.uk/rcc/projects>

Analysis of VLE use is also included in a larger analysis of ICT and e-learning in the post-16 sector in England specifically at <http://ferl.becta.org.uk/display.cfm?page=569>

The VLE JISCmail list also remains a source of useful information:
<http://www.jiscmail.ac.uk/lists/vle.html>

Use of specific VLEs

For details of WebCT as used at Perth College and at Oxford Brookes University, see www.webct.com

For details of the use of Moodle at University of Central England in Birmingham, see www.moodle.org

Appendix - Questionnaire for evaluation of virtual learning environments in higher education sector (Scotland)

1: Please state your institution and position within your institution?

2: How long have you held this position within your institution?

3: Does your institution have a virtual learning environment (VLE) that meets the following definition?

'An on-line learning environment which delivers some or all of a module or programme/course for your student population'.

Yes

No

4: If you answered 'No' to the previous question, please describe any method by which your institution delivers learning electronically.

5: Which of the following VLEs (if applicable) do you currently use in your institution?

Blackboard Basic
Blackboard 6 Basic
Blackboard Learning System
Blackboard Academic Suite
First Class 7.0
Learnwise
Moodle 1.1
Moodle 1.4
WebCT 3.8 Campus Edition
WebCT 4.0 Campus Edition
WebCT 4.1 Campus Edition
WebCT Vista 2.1

6: If the VLE currently in use in your institution was not listed in Question 5 please provide details here.

7: How do you rate the VLE/VLEs in use in your institution on a scale of 1-5 (from a scale of 1, unsatisfactory to 5, highly satisfactory).

1

2

3

4

5

8: How long have you been using your current VLE(s)?

- Six months to one year
- Between one year to two years
- Between two years to three years
- Between three years to four years
- Between four years to five years
- Longer than five years

9: Do you feel with hindsight that the choice of VLE in your institution was the right one?

- Yes
- No

10: Is your institution contemplating changing your VLE?

- Yes
- No

11: If you answered 'Yes' to Question 10, for what reasons are you contemplating changing your VLE?

12: Is your institution contemplating upgrading your existing VLE?

- Yes
- No

13: Would financial constraints affect your institution's choice of VLE?

- Yes
- No

14: Is your institution's decision-making regarding future VLE selection influenced by any 'tie-ins' with a product already invested in?

- Yes
- No

15: At what level are you involved in the decision-making in respect of your institution's e-learning?

- Individual responsibility
- Member of a unit/department
- As part of a university-wide group
- Reporting to senior management
- Member of senior management team

23: (Tools) Which of the following do you think are key components of a VLE?

- On-line assessment
- Library access
- Peer group support
- Synchronous chat
- On-line course application
- On-line course enrolment
- On-line payment of fees
- On-line payment of fines
- Audio clips to support content
- Video clips to support content
- Video-streaming
- Simulations
- Modelling
- Whiteboards
- E-portfolios
- Discussion fora
- File exchange
- Internal email

24: (Tools) Please rate the importance of the following within a VLE.

Not Relatively Desirable Essential Needed unimportant

- On-line assessment
- Library access
- Peer group support
- Synchronous chat
- On-line course application
- On-line course enrolment
- On-line payment of fees
- On-line payment of fines
- Audio clips to support content
- Video clips to support content
- Video-streaming
- Simulations
- Modelling
- Whiteboards
- E-portfolios
- Discussion fora
- File exchange
- Internal email

25: (Technologies) Which of the following do you think are important complimentary components of a VLE?

- Wireless access
- PDA delivery
- Mobile phone delivery
- External access to university network
- Provision of laptops for borrowing
- Desktop access
- Broadband
- International library database search tools

26: (Technologies) How do you rate the importance of the following in the context of your own VLE?

Not Relatively Desirable Essential Needed Unimportant

- Wireless access
- PDA delivery
- Mobile phone delivery
- External access to university network
- Provision of laptops for borrowing
- Desktop access
- Broadband
- International library database search tools

27: (Student Training) Which of the following do you think are the key components of training provision in the use of a VLE?

- On-line training
- Video conferencing
- Classroom training
- Self-directed instruction materials

28: (Student Training) How do you rate the following components of training provision in relation to the use of a VLE?

Not Relatively Desirable Essential Needed Unimportant

- On-line training
- Video conferencing
- Classroom training
- Self-directed instruction materials

29: (Staff Training) Which of the following do you think are the key components of training provision in the use of a VLE?

- Mandatory training
- Group training
- Individual training
- On-line training
- Self-directed instructions materials

30: (Staff Training) How do you rate the importance of the following training methods for the use of a VLE?

Not Relatively Desirable Essential Needed Unimportant

- Mandatory training
- Group training
- Individual training
- On-line training
- Self-directed instructions materials

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