

Perspectives on Pedagogy and Practice

Volume 3 September 2012



Perspectives on Pedagogy and Practice

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Centre for Higher Education Practice

**Perspectives on Pedagogy and Practice
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Foreword

I am pleased to have the opportunity to provide a short Foreword for the second issue of the Centre for Higher Education Practice's Journal, *Perspectives on Pedagogy and Practice*. It is very opportune, coming as it does at the start of the new academic session and the first year of the University's new Corporate Plan (2011/12 to 2015/16). That the Plan has as its Vision, 'Leading in the provision of Professional Education for Professional Life'. One of its two primary and integrated goals is 'to deliver high quality, flexible, student centred programmes of study that are intellectually challenging and which provide our students with opportunities to develop their knowledge, skills and confidence' to gain graduate employment or undertake further study or research.

It is both reassuring and gratifying to note that the contributions to this issue resonate with Plan's emergent themes and explicitly address the institution's strategic priorities as set out in our Teaching and Learning Strategy (2008/09 – 2012/13) namely, retention, student engagement, employability and creativity. I trust that future editions will feature the outcomes of the current ongoing work of colleagues in the areas of student assessment and feedback and on-line delivery.

I also hope the journal's readership will be inspired, encouraged and motivated to participate in the CHEP's activities in 2011/12 and considering disseminating relevant pedagogic research and practice through the Centre's Seminar Series and/or its Journal.

Finally, I would like to thank all those colleagues who gave generously of their time and talents to bring this second edition to press.

Professor Denise McAlister
Pro Vice Chancellor (Teaching and Learning)

Editorial: Volume 3, September 2012

In this third issue of Perspectives on Pedagogy and Practice, ten articles, from internal and external contributors, present different aspects of practice in teaching and learning issues from across the University. These include a range of initiatives concerning, for example, assessment and feedback, problem-based learning, peer led study sessions, learner centered teaching, multimedia simulation, part-time students' needs, promoting stem subjects and degree classification. These should appeal to us all as we consider their relevance to our own professional context.

The external articles represent invited contributions and are written by academics closely associated with the Centre for Higher Education Practice. The first, by Emeritus Professor Lin Norton, CHEP's Visiting Professor, focuses on the concerns of the University of Ulster's academic staff regarding assessment and feedback. The feedback concern most frequently mentioned was unease that our students did not always use the feedback that had taken time and effort to produce. She suggests using the Assessment Experience Questionnaire as a starting point to find out what our students do with our feedback and proposes 'feedforward', feedback which takes place after formative assessment, instead of relying mostly on feedback after summative assessment.

Two of the articles deal with the promotion of problem-based learning (PBL). Hack's paper describes the delivery of bioinformatics to postgraduate Biotechnology students using PBL. It looks in particular at the type of problem scenarios which engage students and which make a PBL approach successful. The authors describe a database of 'tried and tested' problem scenarios suitable for the delivery of bioinformatics to life science students. Hack, McKillop, Sweetman and McCormack's paper deals with the development of an 'one-stop-shop' online PBL centre to provide staff with resources to help them embed PBL in their teaching. This interactive resource includes student centered resources, a database of case studies that can be used for PBL activities and an interactive development template to help staff identify key information needed for successful PBL activities.

Giles, Condell and Zacharopoulou's study explore the benefits and shortcomings of the Peer Assisted Study Sessions (PASS) scheme from the perspective of students who have participated in PASS projects in three separate University Faculties. Their findings suggest that PASS enhances academic performance by providing opportunities for students to clarify their understanding; aids the transition process by allowing students to build supportive networks and provides those trained as PASS Leaders with the opportunity to develop skills that will enhance their employability. They advise that in the future the delivery of PASS programmes will have to be designed carefully around the practical needs of students so that much more regular attendance at sessions can be sustained.

Chen and Davies' article deals with the central issue of introducing learner-centered pedagogy to enrich the learning experience. It describes four teaching and learning activities that have been embedded in the MSc Information and Computer Science curriculum, namely user-centred teaching, individually tailored assessment, research-informed learning, and capability-oriented learning. Whilst Bond's team describes the design of an innovative multimedia simulation to help Clinical Physiology students gain more knowledge and practice in diagnosing cardiac function. They developed the Electrode Misplacement Simulator (EMS), an interactive tool which uses Adobe Flash technology, to allow students to drag electrodes around an image of a torso and get feedback on whether they have been placed in the right position. They emphasize that interactive tools and multimedia simulations, like their EMS, can help students learn effectively in many subjects.

The other articles explore a diverse range of initiatives in teaching and learning. Monaghan addresses a need to focus on support for part-time students. She carried out interviews with part-time Criminology students, and found they felt induction was "rushed" and "confusing" and wanted a specific induction session for part-time students rather than one for both part-time and full-time students. Moffett and Nicell underline an outreach issue - the need for the University to stimulate interest in Science, Technology, Engineering and Mathematics (STEM) subjects. with children. Their Widening Access Skills in Primary Schools (WASPS) initiative contributes in particular to ICT skills development in the primary curriculum.

Pogue, Armstrong, Green, McGrath explore degree classifications and look in particular at the BSc Accounting degree, and find there is an improvement in average award performance when the second year performance contributes 25% to the overall mark. They propose that because of the 25% weighting, students perceived second year performance as more important than previously and that their increased effort led to improved second year performance and, in turn, improved degree classifications.

The final article, our second invited contribution, is by Anthony Cook. He is an Emeritus Professor of Teaching and Learning at the University of Ulster and a National Teaching Fellow. He examines the issue of student retention and explains that the system to which new students have become adapted prior to entry into University differs in aspects of the curriculum, role of teacher, social environment and assessment. He suggests university outreach activities and an extended student induction process are two important activities to improve better alignment between secondary and tertiary education and to avoid students withdrawing from their studies.

This purpose of the journal is to share practice in new initiatives in teaching and learning issues from across the University and so contributions are always welcome, from those who already have experience of pedagogical publishing but especially from those who are new to pedagogical research and writing for publication. I hope you enjoy reading the varied collection of papers in this third issue of *Perspectives on Pedagogy and Practice*. I wish to thank those who have volunteered as mentors to the authors and also members of the Editorial Sub-committee who have served as reviewers of articles. They have all made a tremendous contribution to the journal and without their support it would be impossible to produce a quality journal.

Barbara Skinner
Editor and Chair of the Editorial Sub-Committee

Assessment and feedback: is there anything more to be said?

Emeritus Professor Lin Norton, Visiting Professor, CHEP,
University of Ulster.

Introduction

So much has been written in the last few decades about the purposes of assessment and feedback in higher education, the theory underpinning practice and the apparent problems as evinced by the National Student Survey (NSS) that you, as the reader, would be forgiven for wondering if there was really anything else to say on the subject. In this paper I hope to persuade you that there is an important area that has been relatively under-investigated, that is, the area of the lecturer's or university teacher's perspective. This is one of the reasons why, when working in the Write Now CETL <http://www.writenow.ac.uk/>, I was interested in exploring this aspect further. The findings from our various studies have been reported in Norton et al, (2010, 2011, in press) but briefly, some of the main points include:

1. There is some indication that there are distinct orientations to learning, teaching and assessment which can be broadly described as experiential or professional.
2. 'New' lecturers exhibit desirable assessment design attitudes but also constraints to good practice.
3. Constraints include practical factors (time and workload) and the perception that there is relatively little incentive to introduce innovative assessment practice.
4. There appear to be some disciplinary and institutional differences.

Gibbs (2010) has emphasised the importance of context and I think I agree with him particularly at the level of the subject department. Knight and Trowler (2001) describe the department as a meso level system. They argue that change forces operate best at this level because it provides the connections between the macro level of the institution and the micro level of the individual. Becher and Trowler (2001) talk about 'academic tribes and territories' in relation to the influence of the subject disciplines.

How the paper was conceived

The idea for this paper came from my attendance at Ulster University's 1st annual CHEP conference on assessment and feedback for learning (28 January 2012). As my contribution to proceedings, I asked conference participants to complete a very brief questionnaire asking them to evoke their most pressing concern related to assessment and their most pressing concern related to feedback. In the event, over 70 conference participants took part representing all six faculties, and when I began to read their responses, I realised that this was such a rich and informative data set that it needed more time and space devoted to it than I could do for my reflective paper on the conference <http://www.ulster.ac.uk/centrehep/doc/ConferenceReflective.pdf> , hence the rationale for this second paper.

What follows is a subjective and personalised analysis based on iterative readings, organised and structured to provide the most practically helpful overview. Throughout my discussion I will point to the implications both theoretically and practically for colleagues at Ulster.

Participants

The demographic information is summarised in Table 1. There were also 7 unattributed and miscellaneous responses (e.g. staff development; student and not stated) so these are not presented in the table but are taken account of in the presentation of themes.

Faculty	Number of responses	Schools/subjects	Range of teaching experience in years	Mean of teaching experience in years
Life and Sciences	24	Nursing; Psychology; Sport, Travel and Tourism; Speech and Language Therapy; Diagnostic Radiography; Physiotherapy; Environmental Sciences; Biomedical Sciences; Health and Social Care (Northern Regional College)	5-34	15
Computing and Engineering	12	Engineering; Computing and Maths; Computing and Information Engineering; Computing and Intelligent Systems	5-39	20
Social Sciences	10	Education; Communication; Sociology and Applied Social Studies; Criminology, Politics and Social Policy; Professional Services (Law/Financial services)	2-30	10
Art, Design and the Built Environment	9	Built Environment, Architecture and Design, Art and Design	1-26	13
Business	10	Ulster Business School; Finance, Hospitality and Tourism; Marketing Entrepreneurship and Strategy; Management; Accounting and Business	4-21	12
Arts	4	English and History; Languages and Cultures; Media, Film and Journalism	3-26	14

Table 1: participant demographic information

One of the striking things that Table 1 shows is the significant amount of teaching experience of those staff who took part, so I have presented my findings from the analysis with an understanding of the important part that practitioner experience has to play. Another guiding principle has been that of the importance of the subject discipline when considering assessment and feedback practice.

Analysis

I decided the best way to tackle this task was to firstly get a broad overview by reading all the responses for both assessment and feedback concerns. My immediate reactions were that feedback appeared to be perceived as more 'problematic' than assessment. Specifically, I seemed to be picking up more negative feelings related to feedback such as the demands of accountability and transparency (NSS, QAA, external examiners). I do not think this is surprising as marking and feedback are both very labour and time intensive. I also noticed a substantial concern and 'unknowingness' about whether students take any notice of feedback. It seemed to me that the central problem was not that lecturers do not understand what effective feedback is; they clearly do, but what seems to be coming across is they feel unable to actually put it into practice and they do not know how to make students use it to best effect. Like all qualitative analysis, I am influenced in my interpretations by my own background and by my previous research findings, but this was my starting point.

My next step was to carry out a more formal and systematic thematic analysis by looking at all the responses regardless of faculty. These will be presented under assessment concerns followed by feedback concerns. For both issues, a table was constructed of the main themes, followed by a discussion, further illustrated by representative quotes which presented some more finely nuanced views. Throughout, the faculties are referred to using the following key:

SS	Social Sciences
ADBE	Art, Design and the Built Environment
CE	Computing and Engineering

- LHS Life and Health Sciences
- A Arts
- B Business

Assessment concerns

From reading and re-reading the responses, I constructed 8 themes as shown in the following table:

Assessment Theme		Number of times mentioned
A	Assessment design purpose	29
B	Accuracy in marking	16
C	Perceived constraints to 'good' assessment practice	15
D	Assessment design for differing abilities	12
E	Quantity of assessment	10
F	Timing of assessment	10
G	Involving students in assessment process	5
H	Innovations in assessment	3

Table 2: analysis of responses into themes

Theme A: assessment design purpose

Assessment design is particularly interesting as it demonstrates how academics have to straddle the divide between ensuring standards of achievement (the quality assurance imperative) and enhancing learning (the pedagogical rationale). Some respondents were concerned about assessment being related to future employment and demonstrating fitness to practice; others were concerned about tailoring assessment to develop technical and creative knowledge and skills. A different concern was about students being able to do the basics well such as information retrieval, reading and writing academically:

...develop the students' writing skills. As a practical course we need to assess this element and writing is taking a back seat. Yet it is a skill required within the workplace for our profession to move forward. [LHS]

There was also a common concern about the effects of assessment on students, wanting to devise assessment that motivates and stimulates students as well as meeting learning outcomes and persuading them that the task relates to real life. Some respondents wrote about changing their students' perspective from doing the minimum necessary to doing a good piece of work and shifting the grade obsessive culture to assessment for learning:

... in practice assessment remains largely summative and feeds into learning very little. Attempts at formative assessment are increasingly used and valued but are undervalued, it seems, by the students themselves. [A] That the assessment designed is appropriate and helps the student to become more engaged. [SS]

Making sure students learn from assessment. [CE]

That assessment is a learning process not a tick box to a good grade. [A]

A related issue was that of authentic assessment and developing the student as a person. This last concern was actually a point made by one of the few student respondents in this survey, so is of particular note:

That the assessment is meaningful and it is not just for 'assessment sake' – it should develop the student as a person and have a number of aims, instead of 'let's see what you learnt.' [Student]

There was also a keen desire that assessment should encourage higher order thinking but some intimation that current assessment practice might not actually be achieving this aim:

Am I assessing what I actually want to assess and the learning that has actually occurred rather than give students the opportunity to gather and throw back information to me without actually really understanding it and achieving higher orders of learning. [LHS]

I want to ensure that assessments are useful learning exercises for the students- that facilitate deep learning. [LHS]

Assessment currently tends to check recall rather than application. [LHS]

I was quite surprised in reading the questionnaires that while learning outcomes were mentioned, there appeared to be no overt criticism of them as an assessment practice, although one or two participants did mention testing more than just the stated learning outcomes:

Assessing the LO required but also not over assessing but yet develop the students writing skills. [LHS]

Designing assessment that will not only test LOs but will engage students and get them enthusiastic about the task. [B]

Is it the best method to test the LOs of the students? Fear of students centring their learning solely around assessment. [LHS]

It may be that I am particularly sensitised to this area as I have a subjective, but I would argue pedagogically justifiable, aversion to what I see as the monolithic acceptance of assessing intended learning outcomes (see Hussey and Smith, 2003, for an excellent critique). Eisner (1967) has argued that because learning outcomes have to depend on what can be specified and measured they do not capture the higher order aspirations of the learning endeavour such as understanding and insight. It seems to me that insisting that all specified learning outcomes must be assessed has been a most unfortunate consequence of Biggs' (2003) concept of constructive alignment.

In summary, this was the biggest concern about assessment in terms of the frequency of comments expressed by the questionnaire respondents and in the range of issues described. It actually goes straight to the heart of what I consider to be the irreconcilable twin purpose of assessment; to certify standards of achievement and to improve actual learning. One respondent wrote:

That it is often seen as a problem or burden by staff and students and not fully exploited as a fundamental aspect of the teaching experience and the learning experience. [LHS]

Theme B: accuracy in marking

The next biggest theme demonstrated concerns about marking accuracy, consistency and fairness to students. This particular theme highlights what is one of the other great unsolvable tensions in marking which is that it is virtually impossible to come up with a system that involves human judgment that can be regarded as completely objective, reliable and fair. This is troubling for us as academics as we strive to eliminate subjectivity but find that we have to take a professional expert stance in the final analysis. This is further expressed in the following quotes:

That so often assessment seems to be impressionistic despite marking schemes and criteria it is still a very personal activity. Although we have moderation processes these sometimes serve to leave an assessor feeling the need to defend an assessment judgment. So is assessment fair to the student? [LHS]

When assessing students' work and analysing the marking criteria, I feel that an amount of subjectivity comes into my final judgment. Can this be avoided or should it be included as part of an assessment process? [SS]

That it produces valid results i.e. that only students who are at a (year adjusted) '1st' level should score more than 70%. [LHS]

There was also a concern about the meaning of marking criteria and difficulties in arriving at a common agreed understanding:

The slippery nature of words- those used in describing assessment criteria and how open to very differing interpretations which impacts on the consistency of assessment. How are we to agree the meaning of what we say? [ADBE]

How to manage the marking criteria (particularly reallocating specific grades). [LHS]

Some respondents were concerned about APEL processes:

...especially getting consensus around issues such as relevance, sufficiency, currency, and authenticity of the evidence presented for APEL and around what constitutes reliability and sufficiency of assessment. [B]

What seemed to me to come out of this theme was a real sense of the professional struggle that the participants felt when trying to wrestle with the dilemma of objectivity versus subjectivity. Objective marking has been influenced by behavioural psychology where the emphasis is on that which can be measured and in which concepts of reliability and validity are foregrounded, but this leads to a reductionism to marking what may be superficial. The subjective connoisseurship approach (which has been likened to a wine tasting expert) who will know a good piece of work when they see it but would find it hard to articulate what they know tacitly through years of experience, sits uncomfortably in our current climate of transparency. Eisner (1967; 1998) offers a strong counter-argument to the dominant assessment culture which favours a technical and instrumental approach: 'Connoisseurship is the art of appreciation. It can be displayed in any realm in which the character, import, or value of objects, situations, and performances is distributed and variable, including educational practice (Eisner, 1998, p.63).

Theme C: perceived constraints to 'good' assessment practice

My construction of this next theme was almost certainly influenced by an interview study we carried out with new lecturers (Norton et

al, 2011). This study showed evidence that a number of constraints were perceived which might impede the new lecturers from putting into practice what they had learned about assessment in their PG Cert. programmes. One of the major constraints in that study was seen as practical in terms of workload and increasing student numbers. This was echoed in the Ulster questionnaire responses:

...we do not assess enough but we don't have time, but the pressure is on us to be 'smarter' at setting assessment, but will that not lead to a reduction in deep learning assessment... [ADBE]

Large numbers of students; pressure to meet retention targets. [CE]

Other concerns highlighted external pressures and policy demands:

Time and effort involved in standardising of quality assurance across collaborative activity. [SS]

...also if you want to have more frequent and different types of assessment, you run up against traditional course committee disapproval. [A]

Sometimes the challenge in agreeing a common assessment culture with colleagues was an issue:

Embedding the same culture, expectations, atmosphere, practices and relationships across the xxx team in respect of rolling out a revised curriculum where the design is good but mind-sets around assessment are disparate. [LHS]

I feel that sometimes university policy relating to final year work, can constrain creativity. Sometimes students are happy to work in groups and would prefer to have such work more heavily weighted than individual work. It's hard to keep everyone happy from a policy perspective and to align also with course-level assessment strategies. [B]

So too was the concern about students being strategic and only focusing on assessment at the expense of learning:

Fear of students centring their learning solely around assessment. [LHS]

In summary, this was less of a concern than I would have expected, so one interpretation is that perhaps it is not really an issue. Another interpretation is that because the Ulster respondents were more experienced than our 'new' lecturers, they have learned how to live with and adapt to various expectations that come from requirements for accountability, transparency and students' expectations, in a sector which has declining resources (Gibbs, 2006).

Theme D: assessment design for differing abilities

The fourth theme centred on designing assessment to challenge different levels of ability and to be appropriate to the needs of students; sometimes this was seen as a lack of fundamental academic skills:

The level at which a lot of our students are entering HE level in terms of their written expression and the 'new' learning environment and methods of assessment. Differing challenges but all part of the bigger picture in terms of how do we engage them in 'new assessment techniques' when they lack some fundamental skills. [B]

Establishing assessment tasks which cater for all levels of ability. It's essential to ensure that the 'high flyers' are challenged yet it is also essential to support those students who are less able. [CE]

Differing challenges but all part of the bigger picture in terms of how do we engage them in 'new assessment techniques' when they lack some fundamental skills. [B]

Setting assessment at the appropriate level to challenge, inspire but not be daunting to less able students. [CE]

The other big concern in this theme was to do with large groups or class sizes:

Developing assessment tools with work with large groups.

[ADBE]

One concern is the use of a range of assessment techniques that can be used in large class sizes. (LHS)

Overall, the responses showed a picture of staff grappling with very real issues of dealing not only with students who are less prepared for HE study but increasing numbers. In a wider ranging review of the evidence about the challenges that non-traditional students face, Gorard et al (2006) affirm how the transition to HE is problematic for most students, and particularly for those who come from a non-traditional background. Even for traditional students, the transition from a school system where repeated drafting and highly directive feedback is the norm, can prove to be highly challenging (Beaumont, O'Doherty and Shannon, 2008; 2011).

Theme E: quantity of assessment

A substantial number of respondents identified this as a concern; this demonstrates one of the potential disadvantages of formative assessment, since it usually involves multiple assessment tasks:

The amount of assessment in some areas is excessive. [A]

Over assessment of students especially in context of practice learning. [SS]

Tailoring the assessment into manageable tasks across the semester. [ADBE]

Overburden of assessment within modules and across module-courses [LHS]

Reducing volume of assessment, yet ensuring quality of learning and opportunity for higher grades. [LHS]

For some, getting agreement from colleagues was seen to be part of the problem:

Consensus re. the volume of assessment required in some courses.
[LHS]

What was not always clear from these responses was whether the concern was about over-facing the students or whether it was about over burdening the staff, as clearly it has implications for both. This is a highly personal opinion, but for me this is one of the big drawbacks to assessment for learning as I have seen how a constant diet of coursework assessment raises stress levels in students. For staff, of course it is about increasing what is already seen as a heavy workload. As one respondent put it:

We tend to over assess our students and the more assessment the more feedback time. [LHS]

This is an issue that I will return to when looking at the comments about feedback.

Theme F: the timing of assessment

Questionnaire respondents were concerned about the timeliness of assessment, ensuring that assessment was integrated across the programme and over years to avoid repetition, and ensuring that assessment was related to progression, which inter-relates with assessment for learning:

Ensuring it is timely... is consistent and integrated across the programme. [ADBE]

Making sure there are efforts to ensure that assessment is organised across modules/semesters in a programme. [CE]
Methods used overlap between year groups. Continuity and repetitiveness. [Misc.]

Too many staff use one assessment at the end of a module and expect students to know what is expected. Several smaller assessments would be more appropriate, provided students are given feedback quickly after each hand-in so they can learn from each assessment and use this feedback.
[CE]

This last quote shows a different reaction to the previous theme of over-assessment, where it was seen as a concern. Such contradictory views are entirely to be expected but as previous comments have shown, can sometimes lead to frustrations when working alongside colleagues who have different views of the purpose and practice of assessment.

Theme G: engaging students in assessment

In this theme, staff wrote about finding effective ways of getting students' views about assessment as well as engaging them in the actual assessment process.

How to engage students more in the assessment process. [LHS]

That the assessment designed is appropriate and helps the student to become more engaged. [SS]

Convincing students about the relevance of assessments in relation to all modules throughout their degree and real life. [SS]

The need for an efficient system to collect students' views about assessment. [LHS]

What I did not find was any evidence of anyone wanting to involve students in the actual design of assessment. This is an area that colleagues might want to explore further given the excellent interest and commitment already shown by the Students' Union at Ulster, especially their work on helping students understand feedback. Although involving students in their own assessment might seem risky, there are precedents in the work done with negotiated learning agreements (Boud, 1992).

Theme H: innovations in assessment

This was a relatively modest theme but should not be taken as indicative of a lack of innovative assessment practice, since respondents were only asked about their most pressing concerns. In this light, the fact that there were so few comments here might be interpreted as being relatively unproblematic, but include:

Ease of usability for staff and students for online submission/ assessment and feedback. [ADBE]

Implementing quality peer assessment. [ADBE]

Development of appropriate assessment technological facilitated learning tools for effective assessment. [B]

How best to assess inquiry based learning. Specifically how it can be used to enhance learning without detracting from the research task. [Misc.]

Conclusions

The overall impression that I got from reading and analysing these responses on assessment concerns was that they reflected the situation across the sector as discussed both in the literature and from my own research in this area. Getting this ‘straight from the horse’s mouth’ is a privilege and very important, for as I said in my introduction, not enough attention has been paid to lecturers’ views and experiences. This has implications for future research, for informing assessment policy making and specifically for Ulster colleagues it demonstrates there is considerable scope for carrying out pedagogical research in their own subject specific context.

Feedback concerns

My approach here was the same as I used to analyse the assessment concerns, so I have again constructed a table of themes (Table 3) which I discuss with further illustrative excerpts from participants’ responses. Four respondents interpreted the question to be about student course evaluation so I have omitted these from my analysis.

Feedback Theme		Number of times mentioned
A	Students' engagement with feedback	22
B	Making feedback effective	18
C	Feedback to feedforward	17
D	Time and workload issues	17
E	Students' expectations and understanding of feedback	9
F	Innovative feedback practice	4
G	Large student numbers	4
H	External accountability	4

Table 3: analysis of feedback responses into themes

Theme A: students' engagement with feedback

The feedback concern that was most frequently expressed was unease that students did not always use feedback that had often taken considerable time and effort to produce. This theme highlights the whole issue of the timing and type of feedback that is needed to turn it from feedback to feedforward (Hounsell, 2007; Beaumont et al, 2008; 2011).

Some respondents wanted to know how they could find out if students were engaging with feedback, a question that I can relate to:

*Ensuring it is acted upon and makes a difference. [ADBE]
How to get students to pay attention to feedback and take action on it. [CE]*

That it is not acted upon or followed up by students. [CE]

Ensuring the students take it seriously and benefit from it.

[CE]

Finding a better way of looking at how students use feedback

[LHS]

Getting student engagement with feedback to ensure action and application to further assessment. [LHS]

Students want feedback but do not act on it in a positive way. [A]

That students see its value and use it to improve their future work. [A]

The fact that they just look at the mark and many do not take on board the feedback written to future assessments. [B]

Impact on students. Does it really help students improve their standards/grades? [SS]

It is not possible to ascertain from these comments, what type of feedback lecturers were giving and whether or not it was summative or formative. We might hazard an educated guess that the first of the two following quotes was related to summative feedback and the second to formative, but I might be reading too much here into too little data.

That all the effort and hours I put into writing feedback comments might be wasted if students don't read them/ act on them. [LHS]

That students engage with the feedback they receive. That they collect and use the feedback so that there is feedforward. [LHS]

Nevertheless, the fact that feedback is often summative in Higher Education is worth considering further. Beaumont et al (2008, 2011) have discussed this in detail and put forward the concept of a dialogic feedback cycle. Although this sounds somewhat technical, in reality it has a very straightforward rationale which is to improve the usefulness of feedback that students (particularly those in their first year of degree level study) receive in a manner that does not add extra workload demands on staff but is timely and helpful in enabling students to adapt to the demands of studying at university level. By concentrating on 'preparatory guidance' (explaining criteria, discussing task, modelling answers) and on 'task guidance' (drafts and practice, generic feedback, peers as critical friends) rather than exclusively on 'performance feedback' (standards related, often written), it ensures that feedback is largely formative rather than

summative. This does mean, as Hounsell (2012) suggests, that much less time and effort is put into giving extensive feedback on the actual performance but there should be suggestions for what and how to improve on future work. For one respondent the need for students to use feedback in practical work contexts was an issue:

How to get students to engage and use feedback – easier to put in place for written work but very different for practical work. [LHS]

Another two respondents wanted to know how we could measure whether or not students acted on feedback:

How do we 'measure' that the student has actually engaged with the feedback given. [LHS]

That students can learn or are learning from my type of feedback. I would need more knowledge to take this information to colleagues. [Misc.]

Although I do not wish this paper to be a list of tips and techniques, it strikes me that there is a very useful tool that colleagues might like to try especially if they are considering carrying out some pedagogical research in finding out how students react to and use their feedback. The Assessment Experience Questionnaire (AEQ) has sections on quality, quantity and timing of feedback and what students actually do with that feedback (Gibbs and Simpson, 2003; 2004) The original version has subsequently been refined by Gibbs and Dunbar-Goddet (2007) in a report to the HEA on the effects of programme assessment environments on learning (available electronically). This latest version 3.3 is available in their report as an appendix. I have used the earlier version of the tool in some work I did at Liverpool Hope University and the findings were used in a faculty wide consideration of assessment and feedback practices. Overall the picture illustrated by this theme and the sheer quantity of comments relating to this area show that there is a fairly strong perception that students are not using feedback that they are given.

Theme B: making feedback effective

Some of the issues here revolved around how feedback could be

made positive and motivational, and embedded within this was an acknowledgment of the emotional effects of receiving feedback, particularly if the work has not been very good:

That it is useful, informative, encouraging and brings about meaningful positive change. [SS]

*How to make feedback positive and encouraging [CE]
That it is effective and beneficial to the students and not a critical (and possibly judgmental) view. [Misc.]*

The fact that so often it comes over to breaking bad news and struggling to make it effectively formative. [A]

Different respondents have different strategies, which may be related to the subject discipline:

Students must get feedback (not just the mark) quickly after each assessment. It is also good to give a class general feedback- both good and bad points. [CE]

Ensuring feedback is developmental and that students understand the 'language' dictated by assessment criteria grids and external examiner feedback. [SS]

To ensure that students receive information that will develop their creative practice and self-belief in their work. [A]

Others make more general comments:

Finding ways of ensuring that what I do has a real impact on student learning. [SS]

Providing adequate feedback in a timely manner. [CE]

Providing feedback that is going to be used by the students and actually benefit them. [LHS]

To make it useful for students in order to enhance their future performance. [LHS]

Ensuring students get the most out of written comments in order to improve. [B]

Consistency in feedback to students who can then develop a useful strategy for improvement. [B]

Some respondents expressed a wish to know what was most helpful to students:

What is most helpful to students to discover about their work? [LHS]

That the student leaves knowing how to improve, and not just knowing that they have to. [Student]

Theme C: feedback to feedforward

This theme illustrates a recognition here that some of the concerns with students not engaging with or acting on feedback (theme A), is to do with the need to alter the system from feedback after assessment to feedforward (which is before the assessment is marked). As the comments show, respondents saw the present assessment system as needing improvement in this respect:

That the student can engage with the feedback and progress throughout their course more successfully. [SS]

At present feedback is mostly written as a summative piece once work is marked. [SS]

The purpose of summative feedback- what is it for? Why do we do it? [ADBE]

Want to provide ongoing opportunities for feedback, but module assessment often does not allow for this. Want to see a greater commitment to weekly assessment to feedforward within same module. [LHS]

Courses so often are structured to leave feedback until the end. So being able to give feedback earlier and in a more meaningful (and digestible) form that genuinely promotes development. [LHS]

Timing feedback. I have learnt that summative feedback is often viewed as post assessment comments; I would prefer to give students feedback in time to improve opportunity to achieve. [LHS]

Identifying opportunities for providing feedback that will inform students' future performance in the module- we use a system of block teaching which lends itself to summative assessment but not so readily to formative assessment. [B]

I question 'summative' feedback – this is really post assessment- how do I know the student has gained from the feedback comments. Basically I prefer feedforward or pre-emptive feedback. [B]

Quality and timing of feedback not based on good practice. Students not encouraged to act on it, loop is not closed. [Misc.]

Some respondents made a key point about the extra workload that formative feedback would engender:

My feedback is too late to be effective. How can I move it away from summative without more work? [LHS]

At present feedback is mostly written as a summative piece once work is marked. Other feedback is given as a shared process between me and student peer group on practical exercises. This is a formative process. I would like to have time to develop this process, workload is too heavy. [SS]

While most of the comments were generic there was one that was more subject-specific:

Creating feedforward opportunities for undergraduate students which will be evidenced/support student learning and application of learning in the workplace. [B]

One of the problems with our current assessment system is this dichotomy between summative and formative approaches; Orr

(2007) has called these positivist and poststructuralist approaches to assessment as 'clashing epistemologies.' Taras (2005) made a strong case for not separating the two functions but to see 'formative assessment as a necessary step which justifies and explains summative assessment' (p. 476). This would seem a sensible approach, but it does not deal with the next major set of concerns.

Theme D: time and workload issues

This was a theme in which I expected to see a lot of comments as it is a well-recognised issue across the sector (Biggam, 2010). According to an analysis of surveys of academics' workloads carried out since 1945, Tight (2010) suggested that much of the increase has come about from additional administrative demands. Ulster colleagues made the following comments:

Finding time to give tailored constructive feedback to individual students. [SS]

Timelines of return of work – not possible to meet the 3 weeks turnaround due to internal moderation/cross college moderation process. [SS]

Ensuring enough time is given for face to face feedback. [SS]

Finding quiet time to make sure the student understands it and takes it forward. [ADBE]

Getting good quality feedback to students in a reasonably short time while trying to have a life! [CE]

Time required to give adequate feedback. [CE]

Giving appropriate depth and quality within the timescale available. [B]

Meeting feedback needs and policies, in ways that retain some reasonable quality of academic life and balance with private/family time – backdrop of up to 50 emails a day to sift and with many attached and embedded tasks implicated. [CE]

Giving the most effective feedback when under pressure with other workloads. [LHS]

Time to give adequate feedback to students. They want the grade quickly but providing detailed and helpful feedback takes time. [A]

The problem of workload is exacerbated by the increasing number of students who need feedback:

Due to increasing class sizes on modules (100-150) there is a need for balance in the number/amount of assessment pieces which are undertaken by students. Although multiple pieces are ideal for learning, this is not always possible due to workload. [CE]

And the fact that weaker students need more feedback:

Having time to write the quantity of feedback required to help weaker students improve. [B]

I discuss this further under theme G.

Theme E: students' expectations and understanding of feedback

This was a theme that illustrated some of the frustrations that colleagues felt:

A lot of time and effort can be put into giving feedback and my concern centres around student understanding that they are receiving feedback. [CE]

Convincing students that feedback is feedback and should be incorporated into future work. [SS]

Feedback, in forms other than written, tend not to be seen as such by students. [SS]

Student awareness and expectation of feedback, 'ongoing feedback' not recognised as formal feedback. [ADBE]

Students do not generally understand what feedback is and when they are getting it...many choose to limit its definition to personal one to one feedback and refuse to accept anything else-this is a hard problem to solve and will take time, also student expectations regarding feedback as fee paying individuals is unrealistic.[LHS]

One respondent talked about the worries of giving negative feedback to litigious students, an increasing concern in the current climate of increased fees. This may account for the practice that I am increasingly observing of lecturers who are writing feedback to justify the marks, particularly for external examiners. We are getting into a woeful situation here:

That students will ... switch off defensively if they do not understand that I am trying to support them/not 'condemn' them. Mature students can be very defensive and can 'turn' comments against staff-litigation/court case. [ADBE]

The concern about students' expectations and understandings of what feedback is and how it can be used by them reflects on some earlier findings by Shannon et al. (2008) where we found the issue of 'student consumerism' to be problematic as some of the lecturers we interviewed were worried about their students becoming increasingly litigious and seeing themselves as the customer. This consumer 'power' can be used to question their marks and grades and even their lecturers' ability, which clearly makes giving honest feedback difficult in some situations. Newstead (2002) blames this state of affairs on the assessment system in higher education: "The assessment system we use, for a variety of reasons, leads simply to students simply wanting to get a good mark: they are not really interested in learning for its own sake. Our means of assessing them seems to do little to encourage them to adopt anything other than a strategic or mechanical approach to their studies (p.72)".

Theme F: innovative approaches to feedback

Some respondents were keen to explore more innovative ways of giving feedback, and I infer that this is partly to respond to some of the workload and time issues raised in theme D. Not surprisingly, the answer was seen as using more technological methods, although

it was interesting to see that respondents in only three of the six faculties mentioned this:

Change in the mode of giving feedback to students (conventional to digital). [ADBE]

Benefit of personalising feedback. Explore new ways of providing assessment feedback – audio video etc. [CE]

Catching up with modern technological tools and VLE specialist facilities to enable more efficient engagement in time effective and enjoyable ways (already fairly VLE enabled incidentally). [CE]

Use of technology for effective feedback. [LHS]

Lees and Carpenter (2012) found evidence to suggest that while students were positive about audio feedback they preferred a combination of verbal and written feedback. While this is only one study it is perhaps a caution that we do not see technology as providing the only solution.

Theme G: giving feedback to large numbers

This theme is clearly related to that of time and workload:

Large classes. I like to give detailed individual feedback- very difficult with large groups both in providing it in a timely manner and getting it to the students (they don't always turn up!) [CE]

Finding effective ways of feeding back to large classes. [LHS]

How staff teaching large classes can give good quality feedback. [Misc.]

When staff have numbers as large as over 100 it makes the prospect of giving individualised tailored feedback virtually impossible, which is why the points made by Boud (2012) in his keynote at the CHEP assessment and feedback conference, are particularly helpful. Boud talked about shifting students' expectations from thinking that feedback can only be given by the tutor to

accepting that valuable formative feedback can come from peers, and that students must be actively encouraged to practice judging the worth of their own work.

Theme H: external accountability

This was a theme where I expected there to be a great many comments, in fact there were relatively few, but what they say merits serious attention:

Improving NSS outcomes re feedback. [SS]

That the NSS suggests the sector is weak in the area of feedback whereas, in my opinion, HE is often all about feedback, albeit not necessarily explicit about it. [SS]

... That student groups (year on year) are unrelated so there can be no relationship between years and the NSS. That students are unlikely to give good feedback as they are unwilling to take full responsibility for the outcome (degree grade) of their performance and want to know why it was not better. [ADBE]

Sometimes it feels feedback is more about keeping externals and QAA happy with traceable and accountable feedback rather than its quality and usefulness to the students. [LHS]

That increasing emphasis is placed in this as a result of the NSS and yet in many instances students seem entirely disengaged by the processes of feedback- I feel this is our biggest challenge in the area. [B]

Accountability and transparency while being justifiable in the sense that we need to demonstrate to the public that we are doing a professional job, have at the same time distorted our assessment and feedback practice. Eisner and others have said we have reduced the process to that which is superficial and measurable. This is one of the problems with the National Student Survey. Prosser (2005) sounded a note of caution in how we react to NSS results. He argues that we do not improve student satisfaction by focusing on satisfaction. We need to focus on why they responded in

the way they did which, he suggests is about their prior experiences, their understanding of learning and teaching and their approaches to studying. In terms of feedback specifically lack of satisfaction may indicate that they do not appreciate the feedback they are getting. This was a point that was made by many of the respondents. From the assessment practice perspective, Torrance (2012) writes about formative assessment being at the crossroads and takes Higher Education as a test case where he argues that the paradox of encouraging students to be critical and independent learners is developed in an assessment context where we insist on conformity. In the drive for consistency and fairness to all, we have to tread a delicate line between satisfying regulatory frameworks and assessing in a way that truly encourages independence which, as Torrance suggests, will mean accepting some divergence.

Overall Conclusions

My sense having conducted this thematic analysis was of a vibrant and largely positive attitude to assessment and feedback at Ulster, as demonstrated by the participants. In my initial reading of the questionnaires I had thought that there were more concerns about feedback than there were about assessment but I was mistaken, indeed a word count of the comments showed almost identical numbers for each topic and this was similar across all six faculties. What I did see though was a real concern about whether or not students take any notice of feedback and I could sense some of the frustration that colleagues felt. There is a missing link here and one that could be addressed, for example, by carrying out a simple pedagogical study which might involve using the Assessment Experience Questionnaire.

I had also expected to see more subject specific differences than there were, but what I did find were indications of contextual differences such as practice-based and professional courses identifying specific issues in the design of assessment. Shulman (2005) coins the phrase 'signature pedagogies' to characterise a way of teaching that is to prepare students for various professions. Reimann (2009) characterises it as ways of thinking and practicing and in so doing, makes a similar point that assessment methods will differ quite markedly. In short, one size does not fit all. I agree and although there were many common issues expressed in this survey,

it is important to respect and honour the subject differences too. I do not wish to end with a list of recommendations, as I think the work that has already been done in relation to Ulster's seven principles of assessment and feedback for learning, is a firm foundation from which to build. I would simply like to end by thanking all the seventy plus participants who took the time and trouble to share their thoughts with me. I hope I have done their comments justice.

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Lin Norton is Emeritus Professor of Pedagogical Research at Liverpool Hope University, where she is actively pursuing her research interests on lecturers' views of assessment that began when she was research director of the Write Now CETL. To date this has resulted in the production of the Assessment Design Inventory, available at: <http://www.writenow.ac.uk/outcomes/resources/assessment-design-inventory/> and numerous publications and conference papers, including the latest questionnaire on attitudes to marking and feedback.

Lin is also a champion of action research in the higher education context and has written a book on this topic: Norton, L.S. (2009) *Action research in teaching and learning: a practical guide to conducting pedagogical research in universities*. Routledge.

Since her retirement as Dean of Learning and Teaching at Liverpool Hope in December 2010, Lin has been offering workshops and seminars on a wide range of pedagogical topics. Further details can be found on her website: <http://www.linnorton.co.uk/>

Delivering bioinformatics to postgraduate biotechnology students - the Problem-based learning approach

Catherine Hack, University of Ulster

Introduction

The past two decades has seen the gradual introduction of bioinformatics into life science programmes either as full modules or topics within modules (Hack and Kendall, 2005) and bioinformatics or 'dry-lab' projects are now seen as a challenging and valuable alternative to traditional laboratory projects (Sutcliffe and Cummings, 2007). Bioinformatics is a new discipline which has emerged in response to the volumes of data generated by the new molecular biology technologies. It is primarily concerned with the use of computing tools to allow the management, visualisation, integration and analysis of complex sets of biological data.

Several different approaches have been adopted for the delivery of bioinformatics into life science curricula. A number of studies have advocated the use of a 'workbench', or a specific interface to access a wide range of bioinformatics tools, for example BioManager (Cattley and Arthur, 2007) or the Molecular Science Student Workshop (Jakobsson et al., 2001). Poe et al. (2009) propose the use of 'reusable learning objects' (RLO) whereby topics are broken down into smaller concepts (typically the equivalent of a 1.5 – 2 hour lecture) which can be incorporated into traditional modules. Others advocate an inquiry-based approach to help students understand key concepts and gain practical skills in bioinformatics. For example, Gelbart and Yarden (2006) guide high-school students through a genetic problem through a series of linked assignments. Similarly, Bednarski et al. (2005) developed an inquiry-based lab linking genetic disease to protein structure and function with a cohort of undergraduate students.

The growth in the knowledge base in all areas of the life sciences has led educators to reflect on what comprises the core knowledge for each discipline. It is not possible to continuously add new modules to the curriculum without discarding older 'core knowledge'. This has provided an impetus towards student-centred learning, as it

was widely recognised that it was more important to develop skills in finding and evaluating information than attempt to deliver a comprehensive knowledge of the subject area (Epstein, 2004; Savery, 2006). Problem-based learning is one approach to student-centred learning, characterised by active learning in small groups, the emphasis is placed on the students to identify and acquire the resources required to construct or investigate a problem. In contrast to the inquiry-based examples described above, PBL is characterised by the use of ill-structured problems which require the students to acquire, construct and then structure their knowledge through self-direction. PBL was originally developed in the 1960's to deliver the whole-curriculum in Medical Schools (Barrows, 1996); however some forty years on it has been adopted and adapted by different subject disciplines (Gijbels et al., 2005), and many practitioners recognise that PBL is one teaching method which can be effectively used alongside other pedagogical techniques.

Within our bioscience curriculum at the University of Ulster we aim to provide students with an understanding of how bioinformatics can be used to solve problems in the life sciences. The PBL approach has therefore been adopted to deliver bioinformatics education to students on a number of our undergraduate programmes: Biomedical Sciences, Pharmacology and Molecular Biology and on our Masters Biotechnology programme. This paper demonstrates some of the features of this approach and evaluates the use of problem-based learning for the delivery of bioinformatics to a cohort of students on the Masters programme in Biotechnology.

Methodology

PBL has been used to deliver bioinformatics to postgraduate students on a 1 year masters programme in Biotechnology for over 5 years, as part of a module in Molecular Biotechnology. Table 1 identifies the learning outcomes for this part of the module. PBL is particularly appropriate for delivering the employability skills associated with the module; however, the subject specific outcomes can also be met providing the appropriate trigger is employed in the problem.

Transferable skills	PBL: achievable	PBL: important
Communicate effectively using appropriate media at a professional level	✓	✓
Identify and evaluate appropriate resources for a given task	✓	✓
Manage time and other resources, both individually and as part of a team.	✓	✓
Use appropriate resources to solve problems	✓	✓
Critically assess outcomes of a task, including self-assessment	✓	
Subject specific skill (Knowledge and Intellectual)		
Identify and implement appropriate computing, analytical or statistical solutions to solve problems in bioinformatics/systems biology and molecular biotechnology	✓	✓
Demonstrate competence in analysing and interpreting biological data	✓	
Integrate data from a range of resources and use artificial intelligence approaches such as data mining to solve knowledge acquisition tasks	✓	
Obtain and evaluate appropriate information and tools from a wide range of sources.	✓	✓
Utilise appropriate resources to solve problems in a new context	✓	✓

Table 1: Intended Module Learning Outcomes: identifying those outcomes that can be achieved through the PBL exercise, and those for which the PBL approach is specifically appropriate.

Data from three cohorts (n=10,16,17) of postgraduate students was analysed. The students, who had a first degree in the life sciences, were from a range of nationalities (primarily the UK, Ireland, Greece and India), and ages (22-34).

PBL scenario

Advocates of PBL suggest that the initial problem or trigger for the PBL activity should be open-ended, ill-structured and preferably require a multi-disciplinary approach (Savery, 2006). Since the PBL approach was introduced on this module in 2003, a number of different problem scenarios have been presented to the class (available at: <http://www.systemsbiology.ulster.ac.uk/~kay/cgi/pbl.cgi> (Hack, 2010)), the following scenario is provided as an illustrative example:

Your team at Envotech have been asked to determine whether bioremediation is an option to clean up a groundwater site that is suspected to be contaminated with BTEX.

An equivalent closed problem could be:

Identify the biocatalysts and operating conditions that may be used for the biodegradation of Benzene, Toluene, Ethylbenzene and Xylene in groundwater.

In the traditional closed structure approach, the students may also be provided with additional information such as concentrations, volumes and other processing conditions at the start of the problem, whilst in the PBL approach, the group are encouraged to either request specific information or make assumptions about the process.

In order to encourage mixing between the different nationalities on the course, students were randomly assigned to groups. The aim was to create small groups so that all students had sufficient tasks to maintain engagement with the problem. On a practical level this meant that there was a minimum group size of 3 and a maximum of 5. The exercise included 2 x 2 hour classroom sessions supervised by one member of academic staff and supported by a facilitator. The students had 3 weeks to complete the task.

Session 1: Define the Problem

In the first session students were encouraged to produce mind maps (either on paper or by using the XMind (<http://www.xmind.org>) mind mapping tool) to help them brainstorm ideas, structure the problem and identify tasks. At the end of the session they shared their ideas with the rest of the class. By providing this opportunity to debate and present the problem, both staff and students can ensure that they have identified appropriate task(s), such as identifying pathways, microorganisms and process constraints (temperature, concentrations, flow-rates). Figure 1 provides an illustrative example of a mind map for this problem, indicating the software and databases that the group thought may be relevant, identifying terms that required definition, and identifying process parameters (known and unknown) which they felt would be relevant to the process design. Creating an XMind diagram allowed the group to identify what they 'knew' about the problem, what they didn't know and had to find out. It also allowed them to identify the 'known unknowns' that they would have to make assumptions about. At the end of this session the group could use the diagram to assign tasks, identify what resources need to be explored, and set deadlines. It also provided a project overview which could be shared with the facilitator, tutor and/or the rest of the class. Summing up at the end of the first session was important in providing students with reassurance and for ensuring that pedagogical aims were met, without being too prescriptive. Between the two sessions the students carried out independent study into the problem through research and completion of their assigned tasks.

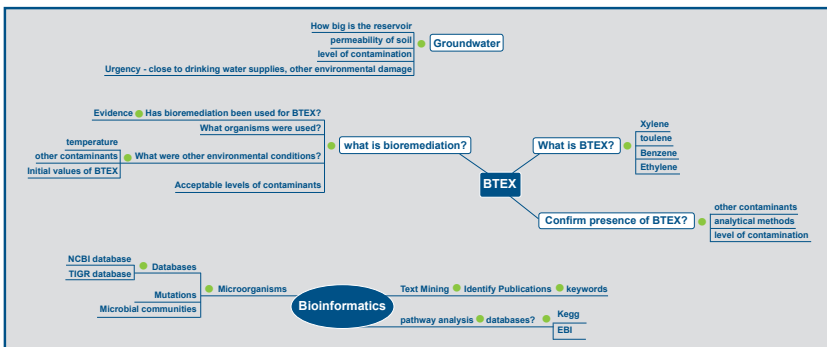


Figure 1: An example of a mind map to help students brainstorm ideas, structure the problem and identify tasks.

Session 2: Integration and Synthesis

Session 2 was driven by the students; they could request further information or clarification; for example some groups raised questions about the unknown parameters, such as temperatures, flow rates and concentrations. As the majority of the class had no previous experience of learning in a PBL environment, this was an opportunity for students to get feedback, and for the tutor and facilitator to monitor groups, and ensure the students were on the right lines to meet the intended learning outcomes. During this session the students worked in their groups, and attempted to integrate their findings.

Assessment

Students were asked to submit a joint report in their own choice of format. Several different responses were produced, including written reports, powerpoint presentations and web pages. The tutor assessed the reports in terms of:

- Knowledge and understanding (40%): identify appropriate databases, use appropriate search parameters, and interpret results.
- Problem solving (50%): use results from databases and literature searches to reach informed decisions about the viability of the process, identify key constraints, limitations, and appropriate solutions.
- Presentation (10%): use appropriate presentation medium, clear concise language and presentation, use of appropriate diagrams, correct referencing.

The online tool WebPA (<http://webpaproject.lboro.ac.uk/>) was used to facilitate anonymous peer and self-assessment, providing an adjusted mark for each individual student, which allowed the PBL process to be taken into account. Table 2 shows the assessment criteria used. Students were asked to rate the contribution of all members of their group (including themselves) on a scale of 1-5. Some explanation is provided to assist the student in assigning a score.

Criteria	Score	Description
Written Communication: An assessment of the contribution of each team member to the written report	1	Little or no contribution, work required correction, and significant editing.
	3	Accurately completed his/her own sections
	5	Accurately completed his/her own sections and provided editorial support for final report
Oral Communication: An assessment of the contribution of each team member to group discussions	1	Made little or no contribution. Did not attend all meetings.
	3	Attended all meetings, active in discussions with considered comments.
	5	Attended all meetings, contributed valid new ideas, and encouraged others to participate.
Team working: An assessment of how each team member contributed to the team.	1	Worked independently, with little interaction with rest of team.
	3	Attended all meetings, completed allocated tasks on time,
	5	Attended all meetings, completed allocated tasks on time, contributed to discussions, supported other team members
Problem Solving: How he/she helped to overcome problems within the task	1	Offered no ideas or suggestions, to solve problems within the task
	3	Offered solutions, suggested resources.
	5	Could identify problems, offer solutions, identified resources, critically evaluate solutions.

Table 2: Peer and Self assessment criteria

Results

Quantitative and qualitative evaluation

In order to evaluate the introduction of this new method of delivery and assessment, a comparison of the marks that students attained in their PBL coursework with marks they achieved on other assignments in the module (an essay and a series of short questions) was performed. Figure 2 shows the distribution of coursework marks for 3 cohorts of students on this module (n=43). The solid bars indicate the group mark awarded by the tutor. Each group member then completed a peer and self-assessment (PA) using the webPA software. The individual mark attained by each student is a product of the group mark, weighted according to PA and the metrics used. In this example the PA weighting was 50%, and a 10% penalty was imposed for non-completion of the PA exercise. The red bars indicate the range of marks attained by individual students within each group. In Group 1 each member awarded themselves and each of their peers similar marks, resulting in a small range of final marks. However in Group 2 there was a much greater range in the weighting of the marks, resulting in a marked difference in final marks. The average mark for students in the PBL coursework was 61% (standard deviation = 14), compared with an average of 66% (standard deviation = 9) for the other coursework on this module. The average student score was lower in the PBL exercise though the assessment was more discriminating giving rise to a wider range of marks, however a χ^2 test indicated that there was no significant difference between the distributions at the 95% level. A two-tailed paired student t test was carried out to determine whether there was a significant difference in the marks achieved by individual students in the two types of assessment. The t statistic was 1.958, indicating that there was a significant difference between the mark an individual student achieved in the PBL exercise and the marks attained in other assessments in the module.

In order to include the problem solving process as well as the development of employability skills (see Table 2) in the assessment, the group marks were adjusted through peer and self-assessment. These two types of assessment were applied to 50% of the group mark, and a 10% penalty was imposed if students did not complete

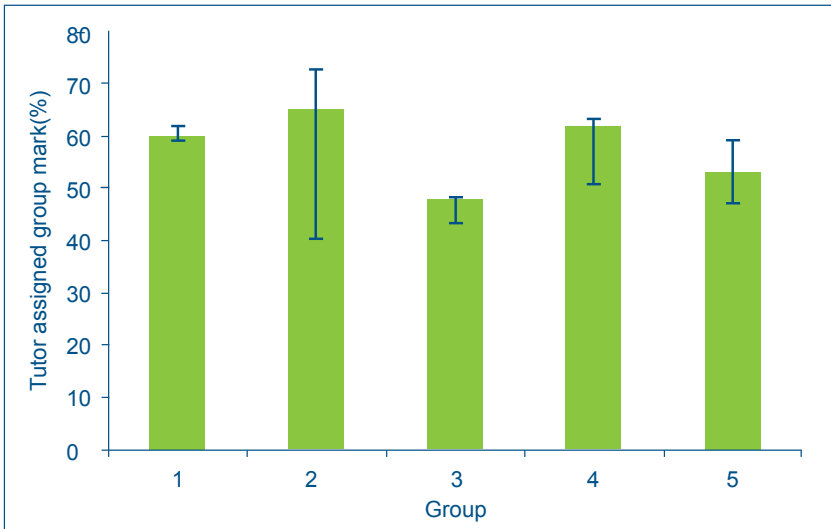


Figure 2: Group Marks for PBL activity. Error bars (|) indicate the maximum and the minimum mark achieved by individual students in the group.

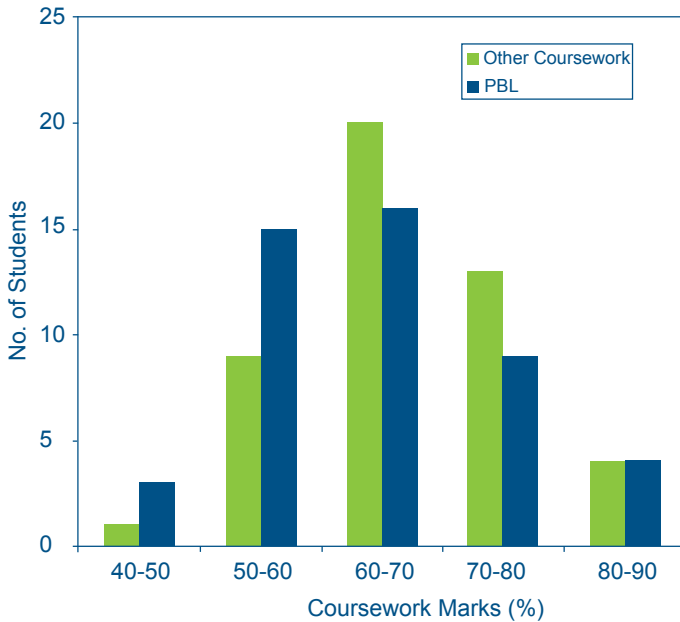


Figure 3: Distribution of coursework marks for the module. Marks for PBL exercise and marks for other coursework activities (essay and short questions) n = 43.

the assessment exercise. Figure 3 provides an illustrative example for one cohort of students with 5 groups, the group mark and the maximum and minimum mark achieved by individual students following moderation are shown.

The PBL approach has also been evaluated qualitatively over a three year period through questionnaires. The questionnaires are available online (<http://www.systemsbiology.ulster.ac.uk/~kay/cgi/pbl.cgi>). Students were asked to rate a number of statements on a Likert scale of 1 (strongly disagree) through to 5 (strongly agree). The questions were grouped into 3 broad areas: peer learning, transferable skills (e.g. communication, team working, presentation etc.) and their attitude to learning via PBL. 75% of the students disagreed with the statement 'PBL has given me more confidence about facing exam questions than traditional lectures'. The majority of students found the PBL learning environment more demanding, over half the students, who expressed a preference felt that PBL was more enjoyable than traditional lectures (Figure 4). However, approximately one-third of the cohort disagreed that PBL was more enjoyable; the majority of this group also agreed or strongly agreed that the PBL exercise was more demanding.

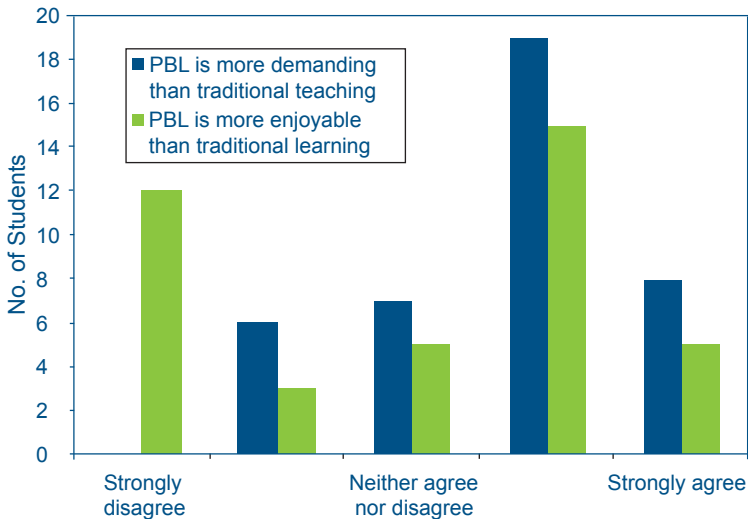


Figure 4: Frequency distribution of response to questions on whether PBL is more demanding and more enjoyable than traditional teaching (n = 40)

One of the goals of PBL activities is to engage students in learning through the creation of a social environment. It was therefore important to try and identify the reasons why these students did not enjoy the PBL activity. The response of students to the questions on peer learning were analysed to try and identify indicators for why some students did not enjoy the PBL exercise.

The data was split into two groups:

- disagreed or strongly disagreed that PBL was more enjoyable (15 students)
- agreed or strongly agreed that PBL was more enjoyable (24 students)

The response to each of five peer learning questions was analysed for each group. The questions which showed the most distinct difference between each group were:

- Working as a group improved my understanding
- I enjoyed sharing my knowledge and experience with my peers

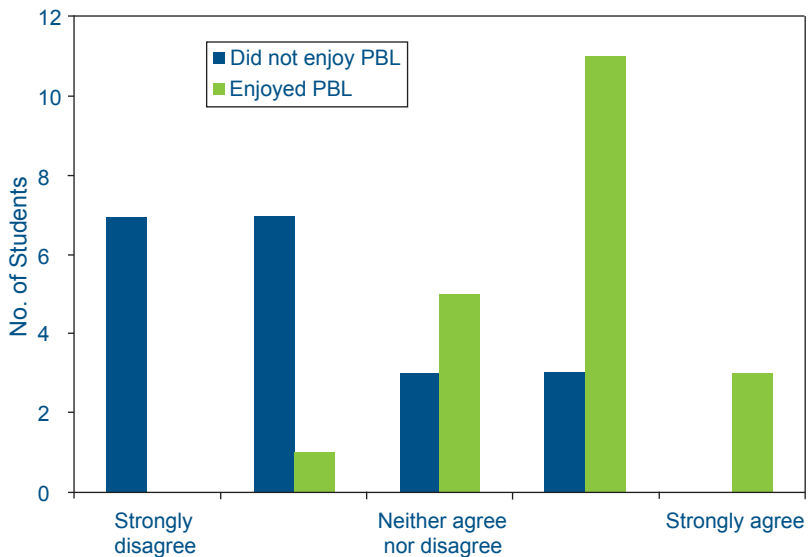


Figure 5 (a): Frequency distribution of response to question “Working as a group improved my understanding” (n = 40).

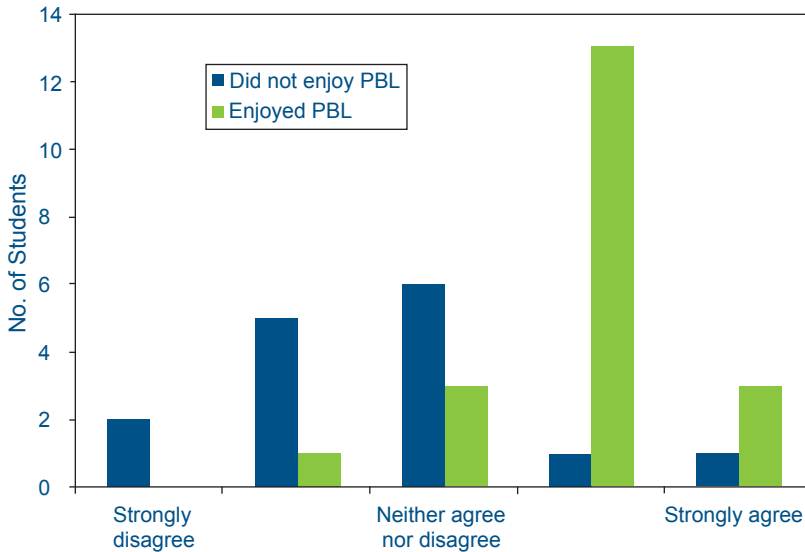


Figure 5 (b): Frequency distribution of response to question “I enjoyed sharing my knowledge and experience with my peers” (n = 40)

Figures 5(a) and 5(b) show the frequency distribution for the responses to these questions for each group. In Figure 5(a) the students’ perception of their understanding is reported. 7/15 students did not feel that group working improved their understanding. In Figure 5(b) it can be seen that students who did not enjoy the PBL exercise, did not enjoy sharing knowledge with their peers. Whilst the numbers involved in this study are small, this analysis provides some insight into the way students perceive the PBL activity, which could be further explored using open-ended questions, interviews or focus groups.

Conclusions

Qualitative analysis of the coursework marks indicated that students who performed well in traditional assessments, did not do as well in the PBL based-assessment, and vice versa. These differences may be expected as the PBL assessment criteria were much broader than those used in the other assessments (essay and short questions) in this module. The PBL assessment criteria included employability skills such as communication, team working and problem solving which are not addressed in the traditional

assessments that were also used in this module. These preliminary results were based on 3 small cohorts (n=10,17,16); however they do raise questions about assessment criteria which warrant further investigation. In a meta-analysis of 68 PBL studies Walker and Leary (2009) investigated the effect of assessment method on the relative performance of PBL compared with didactic teaching. They used Gijbels (2005) method of classifying assessment as either:

- Concepts: understanding of concepts,
- Principles: understanding of the principles that link concepts, or
- Applications: linking of concepts and principles to conditions and procedures for application.

They noted that the greatest effect size (where PBL students performed better than lecture students) was observed where the assessment involved the application of concepts and principles to solve problems. This would support the premise that PBL is appropriate for the type of bioinformatics problems we want our students to be able to solve.

The qualitative assessment indicted that students who did not enjoy the PBL did not enjoy sharing knowledge with their peers, and were not confident about their understanding and knowledge of the subject area. One of the criticisms of PBL by both students and tutors is that knowledge and understanding of core subject specific topics can be overlooked. A meta-analysis of PBL studies with medical students indicated that the students themselves were less confident about their core knowledge (Banta et al., 2000). Discrepancy between perceived knowledge measured through self-assessment and quantitative assessment of knowledge through standard tests, has been observed in several studies. This may reflect the desire by students to be told 'what they need to know', resulting in less confidence in their own knowledge.

The cohort comprised of postgraduate students, primarily from Ireland, the UK, India, and Greece, with first degrees in a range of life science subjects. It was felt that the diversity of scientific backgrounds and experience enhanced the learning environment and added interest and perspective to peer learning, whilst the use of PBL improved integration and interaction. Over the years

of using this delivery method we have observed that an increasing number of students have had previous experience of PBL, although this remained a small proportion of the total cohort (1-2 per intake). Whilst a significant number of students had experience of self-directed learning, some students were used to a much more didactic style of teaching, and required additional support to gain confidence in this teaching environment. At the University of Ulster we use PBL to deliver bioinformatics to both undergraduate and postgraduate students, and it was felt that the maturity of this cohort was a key factor in the successful implementation of this delivery method. In Gijbels' (2005) classification of assessment, it was noted that PBL was shown to be most effective in activities where higher level cognitive skills are assessed, however this does not mitigate against using this approach with undergraduate students, provided they have a suitable problem scenario and appropriate support in the early stages of the problem development.

Notwithstanding these concerns, the course team feel that PBL is an appropriate delivery mechanism for bioinformatics. The continued use of PBL to deliver bioinformatics has been informed by this analysis. In future students will be allowed to form their own groups, rather than being assigned to a group by the tutor. It is hoped that this will increase the enjoyment of the exercise by more students, and encourage student engagement. Secondly, confidence building measures, such as providing formal feedback at the end of session 2, will be incorporated into the exercise. A wiki, which is essentially a piece of software which allows the rapid creation, editing and publishing of web pages, has since been used to support this type of PBL exercise. The wiki is used as a project work-space through which the group can collaborate to construct a solution to the problem. This has benefits for both the student and the tutor; the student contributes to the group work, knowing that their individual contribution can be recognised, whilst the tutor can monitor activity without being visible to the students. This also allows for the provision of 'scaffolding' in the form of support material as required. The use of a wiki promotes engagement, interactivity and a sense of community (Dlouha and Dlouhy (2009), whilst students are more willing to share their own knowledge.

The identification of problem scenarios which engage the whole cohort whilst challenging the most able students is critical to the successful implementation of the PBL delivery approach. The authors have developed a database of 'tried and tested' problem scenarios suitable for the delivery of bioinformatics to life science students (<http://www.systemsbiology.ulster.ac.uk/~kay/cgi/pbl.cgi>). The database was developed through funding from the Centre for Bioscience, through the Teaching Development Fund, and it is hoped that this resource will be used to share and evaluate problem scenarios amongst the academic community.

In conclusion the majority of the cohort found the PBL exercise both more demanding and more enjoyable than traditional teaching methods. PBL and the associated assessment methods allowed students to develop their employability skills, whilst the identification with a real problem and the use of peer assessment promoted student engagement.

Acknowledgements

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Dr Catherine Hack is a lecturer in the School of Biomedical Sciences. She has taught bioinformatics at undergraduate and postgraduate level for over 10 years. She has a strong interest in Problem Based Learning (PBL), and has been in receipt of both internal and external funding to develop resources which support PBL.

Enhancing teaching and learning through establishing Problem Based Learning in academic practice at the University of Ulster

Catherine Hack, Aine McKillop, Sandra Sweetman, Jacqueline McCormack, School of Biomedical Sciences, University of Ulster

Introduction

Problem based learning (PBL) is a student-centred approach designed to facilitate cooperative learning and encourage students to engage in deep learning, fostering and strengthening the reasoning and communication skills necessary for graduate employment. Extensive evidence now exists to demonstrate the value of active and cooperative learning in teaching, learning and assessment (Johnson *et al.* 1991; Mierson & Parikh 2000; Boud *et al.* 2001; Aldrich & Shimazoe, 2010). PBL is a cooperative learning approach that promotes engagement in meaningful learning and promotes skills in acquiring, communicating and integrating information. In the published literature, there are many definitions of PBL, one example taken from Boud 1985 states: “The principal idea behind PBL is that the starting point for learning should be a problem, a query, or a puzzle that the learner wishes to solve.” Students learn best when they are actively involved in the process and ample evidence exists that demonstrates the value of a problem based approach (Johnson *et al.*, 1991; Mierson & Parikh 2000; Hmelo-Silver 2004; Koh *et al.* 2008; Severiens & Schmidt, 2009).

In the School of Biomedical Sciences, the authors have used PBL exercises at undergraduate and postgraduate levels for a number of years, to enhance student learning and foster the development of employability skills to complement content knowledge. The majority of student responses indicate an enhanced learning experience with an overall positive attitude towards PBL exercises. Indeed, the introduction of problem-based e-learning challenged the students to work cooperatively in groups with other students from diverse backgrounds from around the world and to seek solutions while learning from each other. Such problem based assessment strategies when integrated into an e-learning or on-campus forum can successfully engage students in their own learning,

encouraging them to think critically and analytically and to find and use appropriate learning resources. Our experience and research evidence (Hack, 2011) clearly demonstrates that PBL can provide students with a practice based approach that helps stimulate and inspire learning. The positive results from this work encouraged the team to collate and share resources with colleagues in other disciplines. Convincing colleagues to adopt a PBL approach required changes to ideas as well as to practice. Integrating PBL in day to day activities requires professional development of staff and design of enrichment activities for students. In a recent review of methods of educational development (Amundsen and Wilson, 2012) PBL was classified as 'Method Focus', that is mastery of a particular teaching method. The authors state that the key features of an intervention aimed at developing mastery of a new teaching method should:

- place emphasis on learning about a particular teaching method and how to use it;
- ensure that the elements that make up the method have integrity and coherence;
- design training such that it models the method being taught;
- draw on theoretical, ideological, or empirical literature relevant to the particular method.

In this project we have developed a resource centre which encapsulates many of these features, providing a cohesive structured guide to the teaching method which outlines the steps required to develop and incorporate a PBL approach into teaching practice, and provides background information on the pedagogy behind PBL as well links to the pedagogical literature. The project broadly comprises three phases: development of the resource centre, dissemination through workshops and seminars, and evaluation of impact (Figure 1). This paper describes the development and dissemination process and considers whether there are defining characteristics of an educational intervention, which can be used to inform further activities aimed at enhancing teaching.

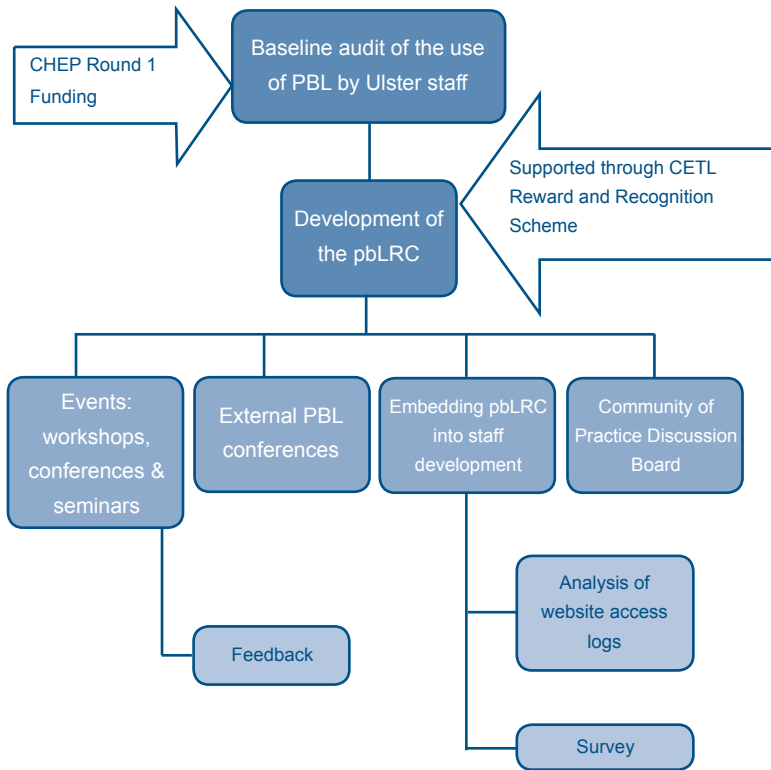


Figure 1: Overview of the development, dissemination and evaluation activities associated with embedding PBL within the University of Ulster.

Development phase

Audit of staff attitudes and experience of PBL at Ulster

The initial development stage included an audit of University staff to determine the extent of PBL activity in the University and the resource needs of staff. The development of the resource centre was informed by a web-based questionnaire which audited current PBL activity in the University and provided a base-line for its evaluation. Responses (n=80) were received from across all Faculties with the majority of responses from the Faculty of Life and Health Science (Figure 2). Of those who responded, 50% had not used PBL, 28% used PBL occasionally and 22% used PBL regularly (Figure 3).

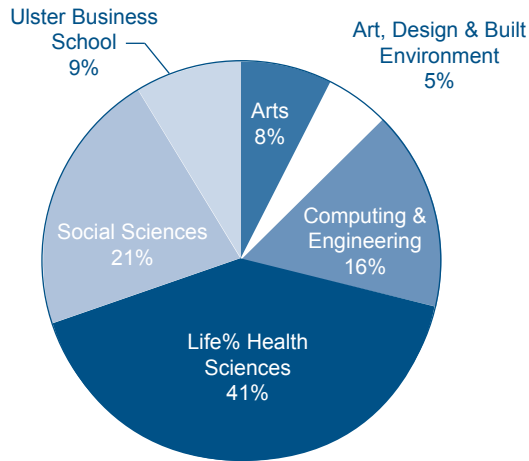


Figure 2: Analysis of the use of PBL by Faculty.

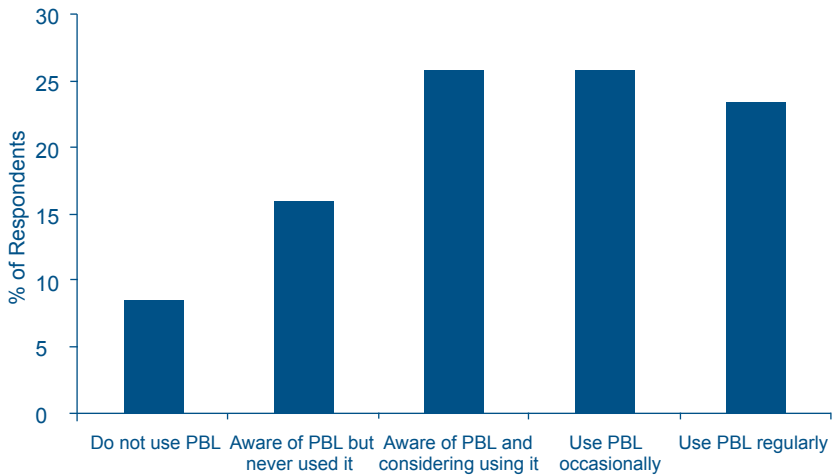


Figure 3: Awareness and use of PBL by academic staff in the University of Ulster.

The responses indicated that staff valued workshops as the most useful resources in developing their own PBL practice (Figure 4). These factors were considered in the development of the resource centre.

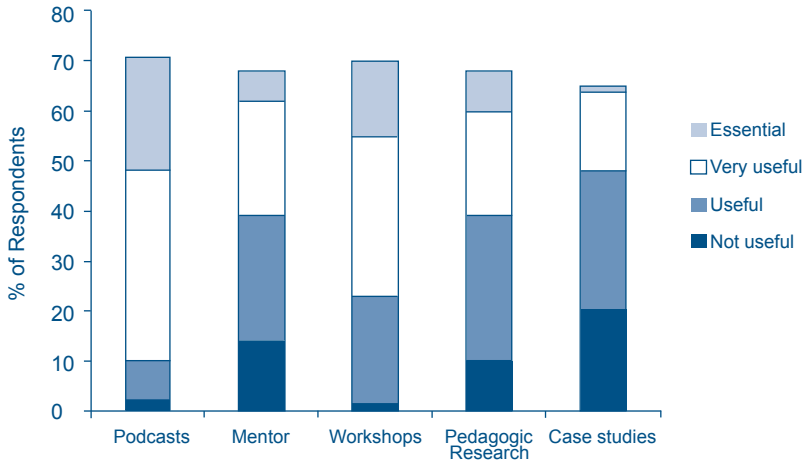


Figure 4: Evaluation of potential academic development activities University of Ulster.

Pedagogic elements of the resource centre design

As the transition from traditional instruction to a problem-based approach requires many changes to the familiar teaching environment, academic staff are often reluctant to attempt a problem based learning approach. There are many issues that educators need to consider in their teaching plans such as: how to find appropriate problems to address content and learning outcomes; how to introduce students to the group process and learning skills; and how to prepare for the uncertainty of a different classroom strategy. Even when choosing a model for PBL, factors such as class size, intellectual maturity of students, student motivation, module learning objectives, instructor’s preferences, the availability of peer facilitators, all need to be considered. Without appropriate support, the benefits of PBL cannot be maximized. Educators need support to identify the most effective model for PBL, the most effective assessment technique, what resources are needed, and access to a range of case studies and exemplary models.

Development of the on-line resource centre to support PBL activities (pbLRC)

Following the results of the audit, the development of the resource centre was initiated, and involved the following key features:

- An on-line resource centre to provide staff with a 'one-stop-shop' to identify resources to embed problem solving and creative thinking in their curriculum design and delivery;
- An interactive development template to facilitate the identification of bespoke information suitable for novices and more experienced practitioners;
- Access to a range of student-centred resources which can be used to support PBL exercises, such as e-portfolios for planning and sharing work; tools for peer assessment of group activities; creative thinking tools; and podcasts of class based PBL exercises;
- A database of case studies that could be utilised by staff in PBL activities. This facility would include a web-interface which would also allow registered users to upload their own activities.

CHEP round 1 funding was received and was critical in funding administrative support, at this stage of the project. The project team also receive technical support through the CETL Reward and Recognition Scheme, this provided the team with the technical expertise to develop the interactive template, and structuring and managing the on-line facility. The resulting on-line resource centre (Figure 5) is now available at <http://www.systemsbiology.ulster.ac.uk/~kay/pbl/index.php>. The facility takes educators through each step of the planning process (Figure 6), and offers examples, benefits and disadvantages of different approaches in the structuring of PBL exercises, for on-campus and distance learning delivery. The pbLRC provides access to: a database of case studies, a facility for users to add their own cases studies, and other resources such as e-portfolios, creative thinking and peer assessment tools; and feedback tools for staff and students.

University of ULSTER Problem Based Learning Resource Centre (pbLRC)
To support and promote PBL

School of Biomedical Sciences

Problem Based Learning (PBL)

- What is PBL?
- What do I want students to learn?
- How will I evaluate the exercise?
- How do I organise group learning?
- How do I write a PBL problem?
- How do I design a PBL class?
- How will I assess student learning?

Teaching plan

- Create Teaching Plan

Resources

- ▶ Student Resources
 - On-line Peer Assessment
 - Mind Mapping
 - E-portfolios
- ▶ Pedagogical Papers
- ▶ Case Studies
- ▶ Ulster Practice Exchange Repository

News

- ▶ Feedback on Resource Centre
 - The development team would be very grateful if you could complete this short survey

Introduction

Problem based learning (PBL): PBL is an educational strategy that helps foster and strengthen the reasoning and communication skills necessary for graduate employment. Importantly, PBL represents a student-centred approach that promotes engagement in meaningful learning and collectively fosters skills in acquiring, communicating and integrating information.

Figure 5: A screenshot of the pbLRC.

Dissemination phase

The objective of the project was to develop a resource which would support staff from all subject disciplines in developing their own PBL practice. It was therefore critical to introduce the pbLRC to staff across the University. This was achieved through a number of activities, including:

- Events: the course team organised a number of events including a workshop and a conference as well as participating in CHEP events such as the Festival of Learning (2010, 2011) and delivering a CHEP lunchtime seminar.
- Poster presentations at Conferences: the course team have designed posters which have been presented at a number of education and specialist PBL conferences, including the University of Ulster Festival of Learning (2010, 2011), PBL Special Interest Group of the Higher Education Academy, (March 2011), and 1st International FACiLiTATE Conference, Irish PBL network (June 2011).

- Embedding the resource centre into formal staff development programmes: the pbLRC has been introduced onto the Student-Centred Learning module PHE701, which is delivered to staff on the Postgraduate Certificate in Higher Education Practice (PgCHEP), and on the Queen Anne Business School (a branch campus of the University of Ulster). The Course Director of the PgCHEP stated that: “the (pbLRC) provides a very useful resource to allow staff to develop and enhance their practice”.
- The provision of a Community of Practice discussion board (<http://teachingcommunity.ulster.ac.uk>) providing ongoing support for PBL practitioners and novices.

Evaluation of the impact of the project

Feedback from staff on the usefulness of the pbLRC and support resources was obtained at a University PBL Workshop and PBL Conference held on the Coleraine and Jordanstown campuses (McKillop *et al.*, 2010). Staff from CHEP and schools including Sport Studies, Health Sciences, Biomedical Sciences, Criminology, Engineering, Education, and Built Environment attended the workshop and provided feedback. They stated that the most useful thing about the workshop was ‘obtaining information about the PBL resource site’. They also commented on the opportunity to work through case studies and hear about other staff experiences. Specific comments were: ‘looking forward to adding to and using case studies from the repository’ and ‘the website as a resource was excellent’. Research indicates that the workshop is the most commonly used intervention for supporting academic development (Levinson-Rose and Menges, 1981), however whilst evidence suggest that the ‘one-shot’ workshop was the least likely intervention to produce lasting changes in practice, both the baseline audit and post-event feedback indicated that staff valued the provision of workshops. The workshop was delivered, in part, using a PBL approach, which is considered to be a key feature of dissemination activities aimed at developing mastery of a particular teaching method (Amundsen and Wilson, 2012). Furthermore the workshops were used as an introduction to both the method and the resources, thus it was felt that this approach was more likely to have a lasting impact than a single workshop.

At the PBL Conference (June 2010), entitled 'PBL: theory, challenges and practice', comments from staff included: 'An excellent opportunity to identify the benefits and possible pitfalls of this approach' and 'discussions were particularly useful particularly as these were cross discipline' and 'the case studies set the context, and realities of utilising PBL'.

In March 2012, the team presented a seminar entitled 'Promoting Collaborative Learning through PBL' via the CHEP lunchtime seminar series. The seminar, which is available on-line (<http://teachingcommunity.ulster.ac.uk>), was attended by staff from across the University, and overall received very positive feedback (Figure 7). Google analytics were used to track visits to the resource centre. Following the lunchtime seminar, there were 10 unique visits to the resource centre. A survey of users of the resource centre indicated that it was visited by both those experienced in using PBL and novices; both cohorts agreed that the resource increased their knowledge of PBL and encouraged them to try PBL in their own teaching.

The ultimate test of whether an intervention has been successfully implemented is the observation of changing practice. Admunson and Wilson (2012) considered that the impact of an intervention could be evaluated both on how well the method has been demonstrated during the dissemination phase and how widely it is adopted after the initial training or dissemination activity is complete. Feedback indicates that staff rated highly the methods used in dissemination (i.e. the resource itself and the workshops and seminars). Adoption of a PBL approach requires a fundamental shift in the teacher-learner relationship to a student-centred culture. For some staff the transition from traditional instruction to a problem-based approach requires many changes to their familiar teaching environment.

The baseline audit indicated that staff from the Faculty of Life and Health Sciences were the most active in PBL. This is not a surprising result as PBL was originally developed in the 1960's in Medical Schools (Barrows, 1996); and spread across other health related disciplines. However some forty years on it has been adopted and adapted by different subject disciplines (Gijbels *et al.*, 2005). In a

second survey of University of Ulster staff, distributed 2 years after the first survey (Hack, personal communication) over a third of the respondents (n=163) expressed an interest in PBL. The pbLRC has been designed to be a University wide facility and internal dissemination activities have attracted attendees from across the University, in particular the focus of the one day PBL conference was to explore the parameters beyond the biomedical science discipline. Evaluation of the pbLRC indicates that the resource centre effectively supports other disciplines in the School, Faculty and University.

Conclusions and Discussion

Any learning environment that is driven by inquiry and collaboration requires planning and often a change to practice. This project successfully developed a PBL resource centre, the key feature of which was an on-line, interactive template, to facilitate the design of PBL activities. The resource centre is a one-stop-shop for all staff wishing to use PBL in teaching delivery with links to student-centred e-learning technologies and pedagogic support material with a searchable database of case studies with tried and tested examples of PBL. Staff have also access to student centred resources, and are linked to a PBL community, a discussion forum for staff interested in PBL. The resources have been presented in a logical manner, recognising the needs of different educators. This initiative provides a management and support facility for the University to promote and foster creativity in curriculum design and delivery, and provides developmental tools to facilitate the different pedagogic approaches to PBL that may exist in different disciplines.

At the workshops, conference and seminars, the team provided examples of how PBL has been used in their own practice. The survey of staff indicated that academics ranked the provision of case studies as one of the most useful resources in developing their own PBL practice. The initial proposal of using the Practice Exchange Repository to share case studies has proved too cumbersome, and a short form will now be used to share case studies on the resource centre. The teaching community discussion board can also be used as a mechanism to share ideas and practice.

The key challenges associated with this project relate to the time commitment required to populate the resource centre with material, ensuring that it was not discipline specific and that all staff interested in developing or enhancing their PBL activities would obtain valuable information for teaching plans. To ensure currency and sustainability the team continues to review and modify the pbLRC, with changes in practice and feedback from staff. The resource centre is currently hosted on a server within the School of Biomedical Sciences, which facilitates the updating of content, however it is envisaged that hosting the resource on a central site would raise the profile of the resource centre.

The course team have been committed to disseminating the resource centre both internally and externally. A number of bespoke events were organised, as well as attendance at PBL and teaching conferences. Attending and organising events clearly requires resources in terms of both time and funding, and it is important to determine which events are most effective in changing practice. In the latter stages of the project Google analytics were used to track visits to the resource centre following events, in future this would be a useful facility to track penetration of the resource centre to the teaching community and evaluate the impact of specific events. Disseminating good practice is critical to the enhancement of the student learning experience. Through this project we have used three phases to encourage the use of PBL throughout the University: resource development, dissemination and evaluation. The course team are committed to encourage more staff to use PBL within their teaching, and continue to pursue new and existing dissemination routes. The use of the teaching community message board will provide access to a network of PBL champions, which we hope will provide the basis of a sustainable and growing community of PBL practitioners within the University, which can offer support to both new and experienced PBL practitioners.

Boud (1999) and Amundsen and Wilson (2012) recognised that there are many different routes to enhancing teaching and learning activities, which can include formal development activities, but also recognise that learning is a social activity, and that students and academic staff benefit from learning within a social context. The project team will continue to support and refine the resource centre

as well as utilise less formal approaches to supporting teaching development activities and evaluating the long term impact in terms of embedding PBL within the University of Ulster.

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Dr Catherine Hack is a lecturer in the School of Biomedical Sciences. She has taught at undergraduate and postgraduate level for over 10 years. She has a strong interest in Problem Based Learning (PBL), and has been in receipt of both internal and external funding to develop resources which support PBL.

Dr Aine McKillop is a Senior Lecturer in Biomedical Sciences and Teaching and Learning Coordinator in the Faculty of Life and Health Sciences. She has been teaching undergraduate and postgraduate students for over 12 years on-campus and by distance learning and has been using PBL in teaching delivery for many years.

Dr Sandra Sweetman is a part-time lecturer in the School of Biomedical Sciences and an e-tutor for the postgraduate distance learning students.

Jacqueline McCormack is a Professor of Biomedical Sciences, undertaking scientific research within NICHE. She is currently the Associate Head of School of Biomedical Sciences. She has extensive experience in the development and use of e-learning and has an interest in the application of problem-based learning, having employed it extensively with both on campus and distance learning students.

Peer Assisted Study Sessions: the evaluation of a cross-faculty initiative in Ulster

Melanie Giles, School of Psychology;
Joan Condell, School of Computing and Intelligent Systems;
Amanda Zacharopoulou, School of Law, University of Ulster

Introduction

PASS, derived from the American model of Supplemental Instruction (SI), is a long running and internationally renowned form of peer learning that involves trained higher year students, PASS Leaders, working in pairs to facilitate regular study groups with students in the year below (Burmeister, 1996). Its purpose is to support the student experience through collaborative exploratory discussion and in so doing, improve academic performance and achievement and reduce student drop-out.

Since its inception within the UK, there has been a proliferation of activity within many degree programmes and research evidence is accumulating to suggest that the scheme is of benefit in raising the attainment levels of first year students (Bidgood, 1994; McCarthy et al, 1997; Coe et al, 1999; Ashwin, 2003). Whilst the quasi-experimental comparison of grades between those who attend sessions with those who do not has led to some criticism of these findings with the suggestion that there may be a degree of self-selection involved, more rigorous longitudinal studies conducted within the US have reinforced the notion that academic achievement is indeed enhanced (e.g. Loviscek & Cloutier, 2001).

However, this focus solely on student performance is not without its shortcomings. For example, Capstick (2004) suggests that it disregards or downplays the limitations of a scheme which in turn may restrict its potential sustainability and wider application and delivery. Perhaps more importantly, he also argues that a focus on performance (and retention) as the primary outcome, has tended to emphasise this as the crux of the scheme, when in fact it may give rise to a number of valuable learning experiences (many of which may be unique to PASS) which are often ignored in the evaluation process. For example, PASS has been reported to enhance study

skills (Price and Rust, 1995) and promote independent learning (Tariq, 2005). It has also been shown to improve understanding of the subject matter of a course (Donelan & Kay, 1998). In so doing, it may also serve to engender enthusiasm for the discipline, provide an additional mechanism for communication and feedback between teaching staff and students, increase group cohesiveness, enhance employability (e.g. Skalicky and Caney, 2010), increase confidence and more generally, enhance the quality of the student learning experience.

Given the above, the aim of this study was to conduct an evaluation of three pilot projects operating in three separate Faculties (Life and Health Sciences, Computing and Engineering and Social Sciences) within the University of Ulster and to explore the benefits and shortcomings of the scheme from the students' perspective. In so doing, it was hoped to further embed PASS within the participating disciplines and to use the findings to further inform its strategic development.

The PASS process

The success of PASS is built on the thorough training of PASS leaders (the senior students), regular debriefing sessions with teaching staff and formative evaluation enabling progressive changes in the process.

The training of PASS leaders is conducted by qualified SI Supervisors (academic staff trained by the UK National PASS Centre to implement and supervise the programme) and involves a compulsory one-day course followed by two discipline specific workshops. Following the training, PASS leaders are assigned a study group which generally comprises 10-15 first year students. Working in pairs, leaders facilitate weekly study sessions which typically last for one hour. These sessions are timetabled and are generally targeted at difficult modules.

The sessions themselves are student led in that the participants are encouraged to set the agenda and identify topics for discussion. This can be difficult particularly in the early stages. However, the focus on group facilitation techniques and associated activities during training

and the emphasis placed on planning sessions during the weekly debriefs (half hour sessions held weekly with the SI Supervisor to review the process), provides the leaders with the skills necessary to empower students to identify topics for discussion. Typically the sessions involve the use of various strategies (e.g. informal quizzes, lecture reviews, visual techniques, problem-solving activities) designed to engage students with the academic material.

Sessions are monitored closely by the SI Supervisors and observed on a regular basis. Feedback is provided during the weekly debrief sessions and is used together with the leaders' reflections to plan subsequent activities. The PASS leaders' commitment and participation in the scheme is accredited as a component of the Certificate of Personal and Professional Development (CPPD), and is also a recognized activity within the new 'Ulster Edge Award'.

The evaluation

The PASS programme targets traditionally difficult subjects and in this instance was attached to modules in each of the three disciplines identified as most at risk as determined by a failure rate in excess of 15%. To assess its impact, both quantitative and qualitative methods were employed to address the following research questions:

- What are the benefits and shortcomings of PASS from the student's perspective?
- What are the benefits and shortcomings of PASS from the leader's perspective?
- What evidence is there to suggest that PASS can enhance academic performance?

The evaluation was on-going throughout each semester in that students have been encouraged to provide feedback during the weekly PASS and debrief sessions but data have been formally collected at two points in time i.e. at the beginning and end of the process. A steering group comprising three Faculty Coordinators, a Placement Officer and student representatives has also met on a monthly basis to monitor and review progress.

Participants and procedure

The evaluation involved students from three disciplines in three schools (Law, Psychology and Maths in Computing and Intelligent Systems). Within each School, two groups of students were included:

1) **PASS participants** (lower year students) involving approximately 120 students in Law, 120 in Psychology and 25 in Computing and Intelligent Systems. The participants' perceptions of the scheme were assessed in two ways:

(i) Questionnaire survey administered to all participants including quantitative and qualitative data. Open-ended questions included at the end of the scheme were of the form:

What are the main advantages and/or disadvantages of attending PASS sessions?

Are there any groups or people who have influenced your decision to attend PASS?

What are the factors that might encourage and/or prevent you from attending PASS sessions?

(ii) Focus group interviews conducted with 7 groups of participants (3 in Law, 3 in Psychology and 1 in Computing and Intelligent Systems), each group comprising between 5 and 7 people, designed to explore the benefits and shortcomings in more depth. Questions were of the form:

What has been your experience of PASS this year?

What do you think are some of the benefits?

What do you think are some of the downsides? Is there anything about PASS that you dislike?

What would you like to see improved or developed in relation to PASS?

(2) **PASS Leaders** (higher year students). PASS leaders work in pairs and were assigned to groups comprising approximately 12-15 students. As such, 12 leaders were involved in Law, 12

in Psychology and 2 in Computing and Intelligent Systems. The PASS Leaders' perceptions of the scheme were assessed through 3 focus group interviews, 1 in each discipline with each group comprising between 6 and 8 participants. Leaders were also asked to comment more generally on a range of issues including:

What have been your experiences of PASS so far?
How have you benefited as a PASS leader?
What do you think students gain from these sessions?
What do you think students might dislike about PASS?
What have you found difficult or not liked about being a PASS leader?

In considering academic performance, the intention was to explore differences in attainment between those who had regularly attended PASS sessions and those who had not. As such, PASS leaders were instructed to be diligent in recording attendance.

Results

Whilst the evaluation is on-going, results to date are very encouraging and suggest that PASS is already having a positive impact on both the students' and leaders' perceptions of the scheme and on academic performance.

Students' perceptions

The qualitative findings highlight the positive benefits of PASS and provide a sense of how it is helping students to clarify their learning. For instance, there is evidence that it is providing opportunities for students to ask questions, make mistakes and build up confidence. For example, students commented:

“Going to PASS means we get a chance to look over our notes and gain a better understanding of what has been taught in lectures. Hopefully that will pay off when we get our results”.

“What I like most about PASS is the less formal, comfortable and relaxed atmosphere, with the freedom to ask questions and

no pressure to answer correctly. It helped me in learning and in understanding the topics”.

“It also provides students with a place to ask questions they didn’t want to ask in the lecture and a place outside their direct friendship circle to get talking to others in the class. It is a place for them to address and solve issues as a group and to leave feeling happy and confident in their ability to do well on the course”.

In addition to academic performance, PASS also seems to be aiding the transition process by allowing students to build supportive networks. For example, students remarked:

“I wouldn’t have made some of my friends if it wasn’t for PASS. It’s good because you have time when you can talk openly to each other about the course and our work because we wouldn’t do it any other time”.

“It sort of helps you make friends. At the start people were really off and didn’t really talk to one another. There was one girl in our group who was really shy and now she is bubbly and chattering away all the time and it is because it came out when we were in our PASS classes really. And then it helps with knowing what is going on and how you are doing and if you are stuck with anything”.

Attendance at PASS sessions has generally been extremely good. For example, in Psychology more than three quarters of the students attended more than four PASS sessions per semester with over half attending them all. However, focus group analyses suggest that lack of structure in some sessions and the limited effectiveness of some leaders may have deterred some students from attending their PASS sessions. For example:

“I wish there was more structure to the classes that would definitely make me go more. Sometimes they (PASS leaders) don’t know what to do with us”.

“I think it works well if it is done well if you know what I mean. If the leaders are doing what they are meant to be doing it works, but when they are just having a chat there isn't much point in going, you could do better on your own”.

Conversely, the effectiveness of some leaders and the influence of significant others were also cited amongst the reasons for going to PASS:

“Our PASS leaders are really nice and easy to talk to. If we don't want to ask a lecturer something in front of everyone in class we can just ask them at PASS”.

“My Dad would expect me to take every opportunity I had to try my best to get a good grade in my degree, so I guess that would include going to PASS”.

Leaders' perceptions

PASS Leaders do seem to be benefiting in a number of significant ways. For example, the process provides an opportunity to revise material which in turn provides an invaluable underpinning for year two and beyond:

“All in all I feel that PASS is a really beneficial scheme for both students and leaders. It enabled me to recap on first year topics and gave me a sense of achievement when helping others”.

“It builds your confidence . . . it is good to keep up because there are quite a few things you forget from the year before so you are refreshing yourself all the time as well . . . PASS sessions were great revision classes for myself”.

Leaders also seem to be appreciating the greater contact it provides with academic staff. This together with the recognition of their commitment provided by the extracurricular modules completed is seen as important in terms of enhancing their employability:

“I like the way I've got to know some staff really well. It has made me feel more important in the department. I think the PASS modules are also good to have on your CV”.

Further, the findings suggest that Leaders value the opportunity to develop a range of skills that will also be important in terms of enhancing their employability. For example:

“I feel the experience was an extremely good one which I enjoyed and I can see it has boosted my confidence as I can talk to people more easily now than I could before. I also feel the experience will benefit me when it comes to future employability as it shows that I can work well with others as well as alone, that I am approachable and friendly. It also demonstrates that I have good time management skills as I achieved everything I planned”.

“It improves your communication skills and it’s good for your CV”.

“It also gave me valuable experience as a facilitator and as a team member, from meeting my co leader to planning and organising weekly sessions to taking part in group discussions. These were all key experiences for me”.

Academic Performance

Findings in relation to academic performance are particularly encouraging. For example, results show that regular participants achieved higher mean exam marks than those who attended PASS only occasionally. This was particularly apparent in Maths (now entering its third year of PASS) where there was an 18% difference in exam performance between occasional and regular participants after year one (regular participants: 75.8% compared to occasional participants: 58.2%) and a 24% difference after year 2 (see Table 1).

	Number Students	Mean Attendance	Mean Exam Result
Occasional Participant (attended 1-5 sessions)	19	1.8	59.8
Regular Participant (attended 6-11 sessions)	6	10.5	83.8
All students	25	6.15	71.8

Table 1: Mean exam results in Maths module for PASS participants for 2010/11

Significant differences were also apparent in Psychology (regular participants: 73.18% compared to occasional participants: 62.05%: see Table 2) and Law (regular participants: 54.03% compared to occasional participants: 47.76%: see Table 3).

	Number Students	Mean Attendance	Mean Exam Result
Occasional Participant (attended 1-5 sessions)	41	3.49	62.05
Regular Participant (attended 6-11 sessions)	66	7.74	73.18
All students	107	6.10	68.92

Table 2: Mean exam results in Psychology module for PASS participants for 2010/11

	Number Students	Mean Attendance	Mean Exam Result
Occasional Participant (attended 1-5 sessions)	54	1.32	47.76
Regular Participant (attended 6-11 sessions)	30	8.90	54.03
All students	84	4.02	50.0

Table 3: Mean exam results in Law module for PASS participants for 2010/11

Moreover, a comparison of assessment marks before and after the introduction of PASS shows significant improvements. For example, in Maths the mean exam mark for COM420 increased from 48.53% in 2008/2009 to 63.58% in 2009/2010 (see Table 4) and to 71.8% in 2010/2011. Further, the fail rate which had typically been in excess of 30% (31% in 2007/2008 and 40% in 2008/2009) fell to 20% in 2009/2010 and to 7.7% in 2010/2011. Similarly in Psychology, PSY131 has experienced a significant increase in mean marks especially for coursework, which rose from 58.42% in 2009/2010 to 83.55% in 2010/2011. Further, the fail rate for PSY109 decreased from 27.48% in 2009/2010 to 12.1% in 2010/2011, thereby

confirming that the results reported above cannot be solely attributed to the better students electing to attend more often.

		Before PASS (mean marks)	After PASS (mean marks)
PSY131	Coursework	58.42	83.55
	Exam	49.54	58.44
	Total	53.74	68.83
PSY109	Coursework	54.58	64.51
	Exam	49.77	48.79
	Total	51.51	54.07
COM420	Coursework	73.33	80.70
	Exam	48.53	63.58
	Total	54.73	67.86

Table 4: A comparison of module marks before and after the introduction of PASS

However, of particular interest has been the finding that lower achieving students seem to benefit most from the scheme. For example, in Maths, whilst there was no difference between regular and occasional participants in terms of the number of first class marks awarded, none of the regular attendees failed the module whereas 23% of the occasional attendees achieved a mark of less than 40% (see Figure 1). A similar finding was apparent in Law which would suggest a need to more fully explore students' motivations to engage with the PASS process and in particular, to identify the reasons why some of our perhaps less able students are reluctant to expend the 'quality of effort' that is required to attend PASS regularly.

Impact of PASS on Math's II Results

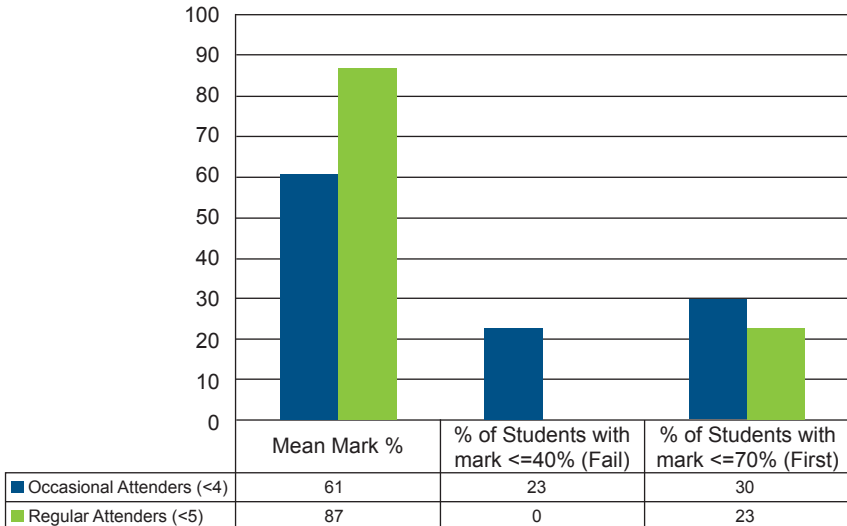


Figure 1: A comparison of firsts and fails for regular and occasional attendees of PASS

Conclusion

Consistent with the findings of previous research (e.g. Capstick, 2004), this evaluation has provided evidence to suggest that PASS has contributed to an improvement in student performance across a range of subjects, an amelioration in student attrition data, the establishment of improved student support networks and the promotion of employability. Indeed, there is much evidence to suggest that the PASS process does give rise to a number of valuable learning experiences and in particular is serving to increase group cohesiveness, increase confidence and improve communication and feedback between teaching staff and students. Of course, we cannot be sure that the findings observed in respect of academic performance are only attributable to the PASS process since other factors (e.g. cohort differences) could have played a role. Nevertheless, the general improvement across all participating modules and the sustained improvement in Maths in particular is difficult to ignore.

Whilst the finding that students at the lower achieving end seem to

benefit most is also worthy of note, it does suggest a need to do more to promote regular attendance at PASS sessions. Given the importance attributed to session structure and leader effectiveness and the finding that those who do attend regularly appear to be more persuaded by the belief it will facilitate learning suggests we need to highlight the academic and social benefits of PASS to students in our promotional materials. For example, in future, test scores from previous academic terms will be reported and national data used to highlight the academic benefits of PASS. We will also ensure careful recruitment, training and on-going support for our PASS leaders. In particular, we will be placing an increased emphasis on planning to ensure a coherent structure to all PASS sessions and will focus more explicitly on the development of employability skills during the weekly debriefs.

However, in a climate where non-attendance at lectures and tutorials appears to be a growing trend, there is a need to more fully explore students' motivations to engage with the learning environment and to identify the reasons why some students are reluctant to expend the 'quality of effort' (Pace, 1980) that is required. In this way, it might be possible to shape the future delivery of programmes to more accurately reflect the needs of students which seems to be particularly important amidst the claims that students are too often presented as the customers of engagement as opposed to the co-authors (Trowler and Trowler, 2010). With this in mind, the aim of future work will be to employ relevant theory to further support the evaluation of PASS and in so doing to identify the factors influencing students' attitudes and motivations to engage with the process and to assess their relative importance. It is hoped that the information elicited will not only serve to inform the future delivery of the programme but will also be of interest to those keen to promote higher levels of engagement amongst the student population.

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Melanie Giles is a Senior Lecturer in Psychology at the University of Ulster Coleraine. She is a registered Health Psychologist and actively involved in research with a specific interest in attitudes and attitude measurement. She also has a keen interest in teaching and learning. She has been the Teaching and Learning Coordinator for the School of Psychology for over ten years and as such is responsible for overseeing the quality of teaching and the development of enhancement activities. She is also a Fellow of the Higher Education Academy.

Joan Condell is a lecturer of Computing and Mathematics and has been a member of the University of Ulster academic staff since 2002. She holds an honours degree in Mathematics, Statistics and Computing from the University of Ulster, an MSc in Industrial Mathematics from the University of Strathclyde and a PhD from the University of Ulster. She has over 80 publications and has obtained research grants from EU and other university/industrial sources and is currently involved in the ongoing daily management of an EU FP7 ICT research project (5.9 million Euros) alongside other research projects.

Amanda Zacharopoulou is a Senior Lecturer in the School of Law. Her areas of expertise include law and computers, computer generated evidence, data protection, privacy, computer crime, computer-assisted learning and its impact in legal education and European law. She is a member of the Irish Association of Law Teachers, the Society of Public Teachers of Law, the Society for Computers and Law and the Committee on the Administration of Justice. She has also occupied various teaching and learning roles within the University including that of Faculty Coordinator for Social Sciences.

Towards a learner-centred systematic pedagogy for enriching and enhancing effective learning experiences for MSc Students

Liming Chen, School of Computing and Mathematics,
University of Ulster

Vicky Davies, Staff Development Unit, University of Ulster

Introduction

The importance and quality of higher education have recently received increasing attention from policy makers as well as from higher education professionals. As a result, various standards for course design and criteria for quality assurance have been established and put into practice (ABET, 2010; BCS, 2010; QAA, 2011). For example, the accreditation criteria for the curriculum design of undergraduate courses in UK universities (BCS, 2010) require that undergraduate teaching and learning target basic fundamental concepts, theories, methods and skills. The emphasis is placed on the breadth and coverage of all relevant topics in a subject area in order for undergraduate students to establish a systematic structure of knowledge. On the other hand, the focus of postgraduate teaching and learning is on a particular subject specialism to provide specific in-depth knowledge and insights. The emphasis is placed on applying knowledge to real-world scenarios and problem-solving capabilities (QAA, 2011). Although the content, study skills and learning objectives for different levels of student cohorts have been clearly defined, there is currently a lack of commonly accepted teaching and learning strategies for these different student cohorts.

It is widely recognised by academics that different student cohorts require different teaching and learning strategies (Brennan and Osborne, 2008; Crozier et al., 2008), and studies also show the strong interconnection between disciplinary culture and subject knowledge (Becher and Trowler, 2001). Nevertheless, studies of university teaching and learning pedagogies remain by and large focused on generic aspects (Neumann, 2001), and ignore the complexities engendered by discipline constraints which may impact on the level of the student cohort. Even within a discipline, the suitability of any pedagogy is topic-bound as well as depending on

the needs of the particular student cohort.

This paper introduces a systematic learner-centred pedagogy that aims to enrich MSc teaching and learning to enhance effective learning experience. The pedagogy is based on a detailed analysis of the student background and learning needs for postgraduate MSc students in Information and Computer Sciences (ICS). It consists of four core teaching and learning activities which have been used to deliver a module for the School's masters courses:

- learner-centred teaching;
- individually tailored assessment;
- research-informed learning;
- capability-oriented learning.

Various teaching and learning activities have been previously studied (Boud, 1995; Race, 2007; Boud and Falchikov, 2007; Fry et al., 2008; Light et al., 2009), but an integrated systematic pedagogy for MSc students has not been examined. Results and findings from this study have provided insights into an integrated pedagogy for MSc teaching and learning. While the study was undertaken within the context of MSc student teaching and learning in ICS, the authors believe the principles are applicable to other disciplines within the wider sphere of teaching and learning at masters level.

Analysis of MSc teaching and learning

The School of Computing and Mathematics in the University of Ulster offers a postgraduate course PgDip/MSc Computing in Web Technology. Within this course, the compulsory Advanced Web Technologies module introduces students to the latest advanced web technologies: in addition to basic concepts, the main module objectives are to provide students with practical experiences of using advanced web technologies to develop and deploy applications for real world problem solving.

As computing technologies and applications pervade every aspect of modern society, students of computing increasingly come from different educational backgrounds. Their first degrees are often from non-computing or non-STEM disciplines. Even within the computing discipline they often come from different courses, having

different emphases, and have different skills and aptitudes, which may be further exacerbated by linguistic difficulties. In addition, MSc students, either full-time or part-time, usually have their own motivations, interests and/or career needs for their studies, and these variations in background, skills, and interests and needs represent a huge challenge for curriculum design.

A systematic learner-centred pedagogy for MSc teaching and learning

To address the aforementioned challenge and provide effective learning experiences for each student, a systematic learner-centred pedagogy has been designed to meet the characteristics of the cohort. At its core, the pedagogy comprises four coordinated teaching and learning activities, each tackling a specific aspect of the challenge. Overall, the four activities form an innovative strategy for MSc teaching and learning, which is described in detail below.

Learner-centred Teaching

Compared with undergraduates, postgraduate students already have extensive learning experiences when they start their course. In addition, they are mature learners, with clear learning objectives and motivation, and as such, they have strong learning “wants” and “needs” (Cavanagh, 2011). Based on these observations and also past tutor experience, we developed a learner-centred teaching approach so as to encourage a proactive attitude towards study.

Specifically, the learner-centred teaching approach allows students to take an active role in the learning process, and emphasises interactive verbal communication, individually-tailored learning objectives, informal but regular discussion and feedback, and independent problem-solving. Students are given opportunities to select their preferred topic within the module and develop their own learning activities, e.g. selecting reading materials from suggested references. To make sure this process aligns with learning objectives, individual face-to-face interactions between the tutor and students, (formal or informal), are offered as a key support to effective learning. Thus students can develop/customise their own study objectives and plans based on their educational background and career needs. Regular meetings with the tutor provide opportunities for students to receive constructive comments

and feedback pertinent to their individual issues. Compared to a more traditional approach of teaching delivery where one-size-fits-all (Rust, 2002; Fry et al., 2008), the learner-centred approach enriches and enhances students' learning experience at an individual level.

Individually Tailored Assessment

MSc students not only have disparate background knowledge, interests, skills and aims, but may also be different in their mode of learning. In recent years, over 35% of enrolled MSc students are part-time students who need to study during their spare time. If assessment is carried out in a uniform way, it is very difficult for one assessment to be suitable for all, since it will inevitably favour those who have the appropriate skills. One solution is to design assessment tasks that can be attempted by all students, but in order for the tasks to be suitable for all they are usually fact-based rather than being able to motivate new ideas and develop capabilities.

As the students have individual needs and/or skills, the assessment tasks must inspire and maintain their engagement, and so an individually tailored assessment strategy has been developed, based on the flexible learning concept. Flexible learning (SQW Ltd and Taylor Nelson Sofres, 2006) is a recent technique that provides learners with choices regarding where, when, what and how learning occurs, and, as such, helps to meet the needs of an increasingly diverse range of students (Qutram, 2010). Individually tailored assessment allows students to decide the type, area and nature of the task from a range of options so as to align this with their professional competencies and/or needs. As a result, students are more likely to be engaged with the learning process and produce innovative learning outcomes.

Research-informed Learning

Research and teaching go hand in hand for high-quality learning in higher education (Lindsay et al. 2002). Previous studies (Barrie, 2004; Calandra, 2002; Brew, 2006) have shown close positive correlations between teaching and research with the potential for both activities to be mutually enhancing. Taking advantage of the extensive expertise available from the research activities of the School, two research-enabled activities were developed to enhance MSc teaching. The first introduces students to research

activities and results relevant to the area of study, focussing on the real world problems being addressed and examining how taught knowledge and skills can be used to solve these problems. The aim is to motivate students' learning "wants" and "needs". This activity could take different forms, including research laboratory visits, demonstrations of existing research prototypes and in-class presentations by guest researchers.

The second activity is to embed research-related problem solving scenarios into the teaching and learning process. The emphasis of this activity is on providing meaningful learning targets in the context of real-life research scenarios, and it is this realism that enhances student engagement with the learning process. In addition, students can work alongside a researcher to gather first-hand research results and trends for their coursework and/or dissertation. Similarly, experience and knowledge gained from the coursework can also inform and, in some cases, serve as the impetus for the corresponding research project.

Capability-oriented Learning

One challenge faced by higher education is the need to keep in pace with constant technology innovations and new real-world problems. This has shifted higher education from knowledge-oriented teaching and learning towards capability-oriented teaching and learning, whereby students become equipped with skills to facilitate independent and lifelong learning. This is particularly pertinent for MSc students given that many are already in the ever-changing world of work.

It has long been recognised that self and peer assessment and feedback can foster independent learning and develop evaluative capabilities (Boud, 1995; Boud et al., 2001). Studies have shown that systematic practice in self and peer assessment enhances learner autonomy, improves performance in final exams and activates intrinsic motivation (McDonald and Boud, 2003; Williams and Kane, 2009). In addition, research has also demonstrated that peer assessment is a potential lever for developing employability skills (Simon, 2006). As such, peer assessment has attracted increasing attention in teaching and learning both nationally and institutionally, as reflected in the University of Ulster's Ulster

Principles of Assessment and Feedback for Learning (Ulster, 2011). Self and peer assessment and feedback can be undertaken in a number of ways and will be dependent on the nature of the subject, the size of the student cohort and available resources.

To maximize the impact of self and peer assessment and feedback for our MSc students, we adopted this key practice within the systematic pedagogy. Self and peer assessment and feedback occur in early-stage assessment elements, so that both formative and summative feedback can be provided to and by students. The self and peer assessment process allows students to develop critical thinking abilities for evaluation and objective judgments against standards, alongside opportunities to learn from peers. Peer and self reflection then feeds into the later assessment elements.

Case Study

The pedagogy presented here was adopted for the delivery of MSc module COM835 in 2009-10. To support learner-centred teaching, the students' educational background and experience were analysed in depth to inform the content of the module and so provide appropriate choices and learning flexibility. A number of advanced web technologies were selected for inclusion, including social computing, semantic web and web services, so as to meet the diverse range of students' background and needs. Assessment elements were designed with multiple options so students' choices were informed by their individual profiles; for each option a number of application scenarios were suggested for selection. Regardless of the option selected, the learning objectives are the same. The element of choice which fires their enthusiasm is key, and they are able to apply the acquired knowledge and skills to address a problem, and, in the process, develop their capabilities for future problem-solving. Crucial to this process is the integration of real-life problems and current research expertise within the School. One scenario using research on semantic technologies and smart homes (Chen et al., 2011) shows the students how the School's smart laboratory, and in particular, the smart kitchen, enables and supports the rationale for an ambient assisted-living paradigm to address the problem of the ageing population. These teaching and learning activities provide students with a real-world problem (the

ageing population), and one of its solutions (smart home based assistive-living). Most importantly the activity demonstrates how semantic technologies can be applied to solve a real world problem, thereby inspiring students' learning motivation.

With regard to the design and execution of assessment, one piece of coursework asks students to conceive, specify and design a novel web application based on the rationale and paradigm of one (or more) of the latest web technologies. Following the idea of individually tailored assessment, students are encouraged to come up with their own project ideas including application scenarios, underpinning technologies, implementation methodology and business models. To assess the coursework, each student is required to make a formal presentation about his/her project, followed by a question and answer session with their peers to elicit strengths, weaknesses and any potential improvements. Based on these activities, each student reviews and marks the other students' coursework with written peer feedback. The tutor then moderates and provides individual feedback to each student. Students are then asked to reflect on their own work based on the peer and tutor feedback received, and their own experience of peer marking.

Results and discussions

Two surveys have been conducted in order to assess the effectiveness of this MSc teaching and learning pedagogy. One survey sought opinions on self and peer assessment. The results as presented in Table 1 are quite positive and encouraging. On average 62.5% students agree or strongly agree to all questions.

“Watching other students present their ideas, helps with public speaking and most importantly helps us learn from each other”;
“Very good idea and very good way of encouraging students to participate together, share ideas and it is a more enjoyable way of learning”.

The only exception occurs for Question 4 where only 12.5% students agree, 37.5% students disagree or strongly disagree. This resonates with Simon's study (2006), which found that “students expressed a positive attitude towards peer assessment but had concerns relating to their capability to assess peers and to the

responsibility associated with assessing peers”. Another potential reason may concern the lack of anonymity in peer assessment and the lack of objectivity of students’ comments. In this case, students are more likely to trust a lecturer’s comments than their peers’ because the former is seen as more knowledgeable and in a position to be fair. Nevertheless, this is a valuable finding worthy of further investigation. It is worth pointing out that this survey also poses questions directly or indirectly related to other teaching activities. Question 6 probes students’ opinions towards individually tailored assessment (87.5% students agree or strongly agree), and Question 7 examines students’ opinions towards learner-centred teaching (62.5% students agree). As such, the survey provides a general evaluation of the teaching and learning activities, and its results indicate that the proposed MSc pedagogy enriches teaching effective learning experiences.

The second survey - the Student Survey on the Quality of Teaching - is conducted online by the University, and forms part of the University’s Quality Management and Audit processes to obtain students’ opinions on the overall quality of teaching on a specific module. As such, the survey results are considered to be fair, objective and authentic, and are used by Schools as a quality indicator of teaching. Table 2 shows the survey results for academic years 08-09 and 09-10 respectively. Overall, 68.75% of students answered 11 questions, resulting in 121 quality comments ranging from Strongly Agree (5) to Strongly Disagree (1). The integrated pedagogy had not been fully introduced in the 08-09 academic year, but the changes in the mean satisfaction values in Table 2 strongly indicate that the learner-centered integrated pedagogy has enriched and enhanced students’ learning experiences in the following year (Table 2).

The aggregated survey results for 09-10 academic year, as depicted in Figure 1, are as follows: Strong Agree 47.11% (57/121), Agree 38.84% (47/121), Neutral 13.22% (16/121), Disagree 0.83% (1/121) and Strongly Disagree 0% (0/121). Nearly half of the surveyed students chose “Strongly Agree” for all questions, and overall 85.95% gave positive responses (Agree and Strongly Agree), with only 0.83% choosing to “Disagree” or “Strongly Disagree”.

No	Questions	Student Opinions (%)				
		SA	A	N	DA	SD
1	To review and mark fellow student's course-work helps me deepen and widen my knowledge and understanding on wider topics.	25	50	25	0	0
2	The preparation and delivery of the Powerpoint presentation about project ideas and design provide rich learning experience and useful skills.	12.5	62.5	25	0	0
3	Self-reflection on peer feedback helps me learn and improve from multiple objective third-party perspectives.	12.5	62.5	12.5	12.5	0
4	Peer student's comments and feedback are more relevant that teacher's comments and feedback.	0	12.5	50	25	12.5
5	The learner-centred self- and peer assessment approach improves learning engagement.	12.5	62.5	12.5	12.5	0
6	Having the choices and freedom to formulate and design own project ideas is more motivating to learn than the one-project-for-all practice.	12.5	75	0	12.5	0
7	Verbal communication, presentation and interactive discussion are a more effective learning approach that traditional paper-based feedback.	0	62.5	37.5	0	0
8	I will recommend self- and peer assessment to other MSc modules.	0	62.5	25	12.5	0
9	The comments and feedback from peers are constructive and helpful.	25	50	25	0	0
10	Self- and peer assessment is interesting and more effective than traditional assessment approaches.	25	37.5	37.5	0	0

SA-Strongly Agree, A-Agree, N-Neutral, DA-Disagree, SD - Strongly Disagree

Table 1: Self and peer assessment survey and results

Questions	08-09 Mean	09-10 Mean
This module was delivered in a way that was clear and consistent with its stated learning outcomes	3.00	4.36
My learning experiences on this module were interesting and engaging	3.75	4.18
There were appropriate learning resources available to support this module	3.75	4.18
Assessment requirements and the criteria used in marking were made clear	3.25	4.36
I found the assessment fair and reasonable	3.00	4.36
Feedback on my work was prompt	3.00	4.18
I received constructive feedback when needed	2.25	4.00
The tutor(s) was/were enthusiastic about what they were teaching	3.50	4.55
The tutor(s) appeared to be well prepared and presented the material in an organized manner	3.50	4.55
I was able to contact the tutor(s) for support and/or guidance as required	4.50	4.45
Overall I am satisfied with the quality of the module	3.00	4.36

Table 2: Official student survey results on quality of teaching undertaken by University

Qualitative feedback on the overall delivery of the module has been very positive:

“The choices of coursework were appreciated.”

“The subject content was engaging and innovative.”

“The lecturer is well prepared and respected our opinions even in designing the slides and topics.”

“This was a fantastic module to attend, the teaching was superb and the subject matter was some of the most interesting I have ever encountered.”

“It showed a few technologies that I was not interested in. However, now I am.”

As can be inferred from the survey results, the integrated pedagogy for MSc teaching and learning has been well received by the students and demonstrates a positive reaction to the enriched teaching and learning experience. From the lecturer’s perspective, the students have responded to the module with increased learning interests, sustained engagement and independent learning capabilities. In addition, average module marks have increased, being 62.5 and 64.7 for 08-09 and 09-10 respectively. Whilst it is too soon to conclusively attribute this to the change in pedagogic approach, Initial indications are encouraging, and worthy of further longitudinal study.

Conclusion

This paper has described a systematic learner-centred teaching and learning pedagogy for MSc students, conceived and designed based on prevalent characteristics of MSc students. Findings from two surveys and the performance results of the student cohort indicate that such an approach has enriched the student learning experience and enhanced the quality of teaching and learning. Whilst the pedagogy presented here was developed on an analysis of MSc student cohorts in ICS, many of the characteristics, particularly those pertaining to disparity in educational background and career aspirations, are common to most MSc students in STEM disciplines. As such, the overall pedagogy has generic applicability, since its rationale and methodology is subject independent, and the activities may be tailored to suit a particular discipline.

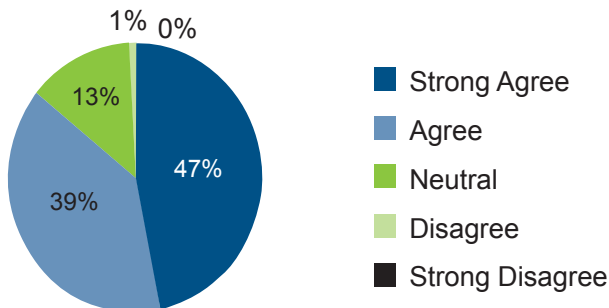


Figure 1: The analysis of survey results for 09-10 academic year

While preliminary results have demonstrated the pedagogy is effective, long-term large-scale evaluation is still needed to refine and conclusively validate the pedagogy. Further studies on the adoption of this approach within other disciplines are also required in order to fully gauge its applicability and adaptability.

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Liming Chen is a lecturer at the School of Computing and Mathematics, University of Ulster. He received his PhD in Artificial Intelligence from De Montfort University, UK. Dr. Chen is active in both teaching and research.

Vicky Davies is a Professional Development manager based in the Staff Development Unit. She teaches on the PgCHEP programme and is Chair of the Centre for Higher Education Practice's Research & Practice in Higher Education Sub-committee.

Can multimedia simulations improve student learning? A case study from teaching Clinical Physiology

Raymond Bond, Computer Science Research Institute,
School of Computing and Mathematics, University of Ulster;
Cathal Breen, School of Health Sciences, University of Ulster;
Dewar Finlay, Chris Nugent, George Moore and Daniel Guldenring,
Computer Science Research Institute, School of Computing and
Mathematics, University of Ulster;
Galen Wagner, Duke University Medical Center, Durham, NC, USA

Introduction

Within pedagogy, whether it involves teaching Psychology or Chemistry, keeping students engaged with learning the core concepts of a topic is, at times, a challenge. However, instructors are fortunately no longer restricted to using a blackboard, but have a variety of modern teaching tools to exploit. One such tool is multimedia, which includes the use of images, audio, video and animation. Multimedia is also often coupled with a high degree of user interactivity. It can be used to translate educational material using straightforward techniques such as video, or more advanced techniques such as interactive gaming. Gaming in the context of pedagogy is known as gamification, which is currently a topic of growing interest in the research community, and particularly the medical domain (Akl, 2010). Nevertheless, perhaps one of most effective educational tools is the use of multimedia simulations. A multimedia simulation allows a student to interact and engage with an imitation of some process or task, which they are required to learn (Bradley, 2006). There are a number of advantages to multimedia simulations. From a technical perspective, they are often developed to run inside a Web browser, which allows a student to access the content independent of geographical location. These applications are specifically called Web Based Simulations or WBS (Byrne, 2010). One of the main educational advantages of a multimedia simulation is that students can learn in a visual and interactive (kinaesthetic) manner. The interactive nature allows students to play around in a virtual environment whilst experiencing and learning the effects of right and wrong actions. A multimedia simulation can also be described using the old cliché - *“learn by*

doing”, but without the expense of real life consequences of any wrong actions. The use of interactive multimedia to assist student learning can be used in many domains and at many levels. For example, Sharp and Hall (2001) used interactive multimedia software to educate postgraduate engineers. In order to promote ‘technology enhanced learning’, the authors believe multimedia is an essential tool to the ‘educational technologist’. It is however, arguably, a ‘design science’ (Scanlon, 2010). Nevertheless, in this paper the authors introduce a multimedia simulation tool that was used to aid the teaching of Clinical Physiology. More specifically, it was used to help students gain more knowledge about the 12-lead Electrocardiogram (ECG).

The 12-lead Electrocardiogram (ECG) is the most widely used tool for non-invasive assessment of cardiac function (Wagner, 2008). A 12-lead ECG is recorded using six chest electrodes and three limb electrodes. These electrodes must be positioned at precise anatomical landmarks that were endorsed in 1938 to standardise how clinicians record and interpret the 12-lead ECG (A.R. Barnes *et al.*, 1938). Each lead is represented by a signal, which is a continuous waveform. An example of 12 signals (leads) can be viewed in Figure 1 and the correct positioning of the electrodes are shown in Figure 2.

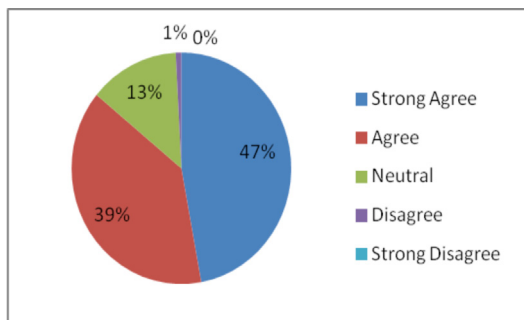


Figure 1: The 12-lead ECG printed onto graph paper

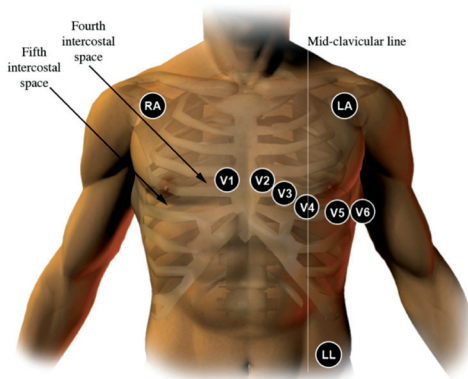


Figure 2: The correct positioning of the three limb electrodes and the six standard chest electrodes

Figure two shows the positioning of the three limb electrodes (LA stands for Left Arm, RA stands for Right Arm and LL stands for Left Leg) and the proper positioning of the six standard chest electrodes. Electrode V1 is positioned at the right edge on the sternum border in the fourth intercostal space, V2 is placed in the left border of the sternum also in the fourth intercostal space, V3 is positioned between V4 and V2, V4 is placed in the fifth intercostal space aligned with the imaginary mid-clavicular line, V5 is horizontal to V4 and aligned to the imaginary anterior axillary line and V6 is horizontal to V5 aligned with the imaginary mid-axillary line.

Although the 12-lead ECG must be recorded in a particular way, there are 12 million incorrectly recorded 12-lead ECGs out of the estimated 300 million recorded every year (Heden *et al.*, 1996). This is a problem that needs addressed because when electrodes are misplaced, the physician can misdiagnosis a patient. This can be detrimental to the patient if appropriate therapy is withheld or if unnecessary therapy is administered (Rudiger *et al.*, 2007).

Despite these facts, inadequate education is provided to students regarding the effects of electrode misplacement. According to Rudiger *et al.* (2003), ECG textbooks contain little or no information about the effects of electrode misplacement. Moreover, a widely used practice in the education of students is the use of life sized physical mannequins. Using these mannequins, students can

simulate and exercise medical procedures. They also allow students to practise placing ECG electrodes. These mannequins, however, lack any kind of feedback and do not allow students to see the effects of electrode misplacement on the actual signals. In an attempt to address this issue, we developed a novel multimedia tool called the Electrode Misplacement Simulator (EMS). This was developed using the Adobe Flash technology. The EMS is an interactive tool that allows students to drag electrodes arbitrarily around an image of a torso whilst viewing the effects this has on the actual signals. The EMS software is Web-based and available on the Internet (Bond, 2010a). The tool uses an algorithm that utilises pre-recorded data to simulate what the ECG would look like when the electrodes are moved. Images of the EMS are shown in Figures 3 and 4. Full details of the functioning and utility of the EMS software can be found in a previous article (Bond *et al.*, 2011). This study uniquely tests the hypothesis whether the use of a multimedia simulation can improve student learning. In particular, this study assesses whether the EMS provides a better understanding of the ECG, and the effects of electrode misplacement.

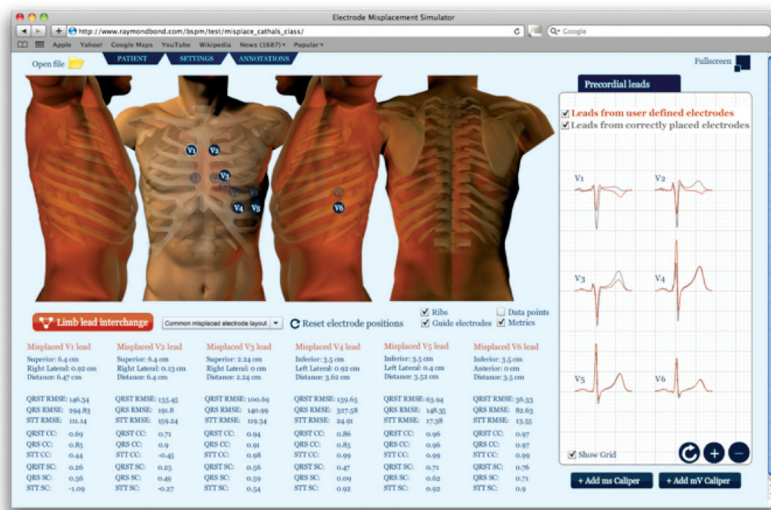


Figure 3: A screenshot of the EMS showing the chest electrode placement feature

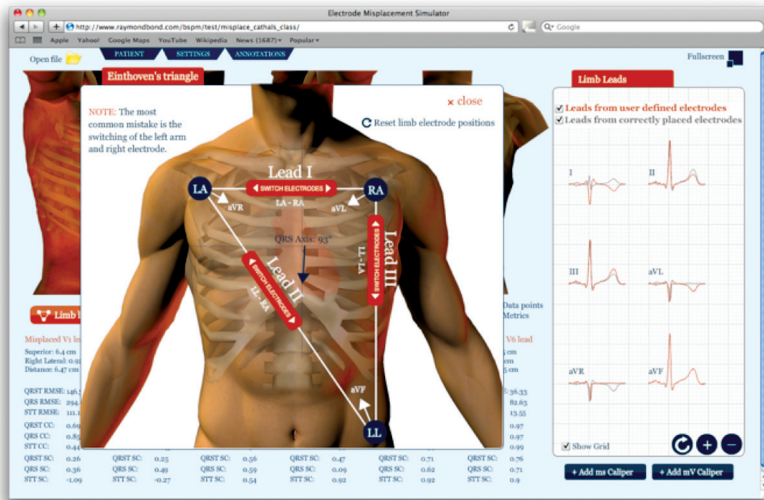


Figure 4: Screenshot of the limb electrode placement feature in the EMS

Methods

This study is comprised of 23 undergraduate students enrolled on the second year of a Clinical Physiology program at the University of Ulster. The study was carried out prior to placement year, where students are required to work in actual clinical practice and are therefore expected to have a certain level of competency to record a 12-lead ECG. Eleven students (experimental group) were randomly selected and given access to the EMS for one week. Each student was given unique login details so that their level of engagement could be monitored. These students used the EMS in their own time for visualising and studying the effects of electrode misplacement on a normal 12-lead ECG. The remaining 12 students (the control group) did not use the EMS (nor were they informed about it) and relied solely on lectures and traditional teaching methods for tuition. The experimental group were informed not to share the EMS software with the control group. All students from both groups were informed that a class test relating to the effects of electrode misplacement would take place the following week. However, they were also informed that the results would not be assessed as part of the module. After seven days, nine students from the experimental group (age: 23 ± 4.05 , gender: 7 females and 2 males) and eight students from the control group (age: 20.75 ± 2.60 , gender: all

females) completed the class test. The experimental group (nine students) completed an additional questionnaire that assessed the usability of the EMS and its graphical interface. Following the class test, participants from the control group were also given access to the EMS for their own future learning. The actual class test (Bond, 2010b) and the usability questionnaire (Bond, 2010c) are both available on the Internet.

Results

With respect to the control group, the mean score from the class test was 44% or 11.56 (± 2.83) out of a possible score of 26. With respect to the experimental group, the mean score from the class test was 63% or 16.44 (± 2.24). The scores from both groups have been illustrated in Figure 5 by the normal distribution generated by the mean and standard deviation. On interpretation, the experimental group performed approximately 20% better on the class test when compared to the control group.

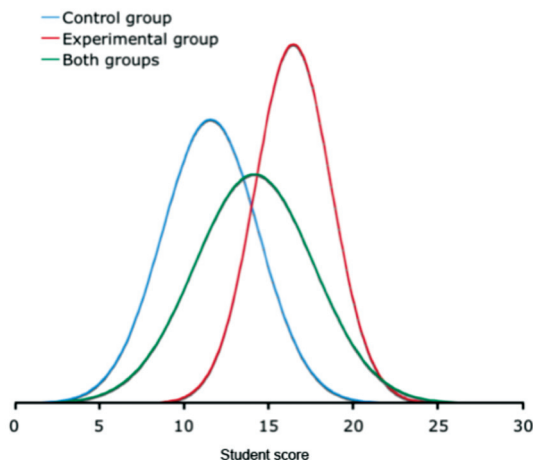


Figure 5: Performance differences between the control group and the experimental group

These distributions in Figure 5 were calculated using the mean and the standard deviation from the control group and the experimental group. Therefore this figure is only for illustration purposes and is not an exact representation of the data. Also for the purposes of illustration, a distribution has been calculated to represent all students from both groups.

An unpaired two-sample t -test was used to examine the hypothesis that the EMS improves student understanding of ECG acquisition practices and the effects of electrode misplacement. For this context, the t -test is a suitable hypothesis test given it is used to verify whether there is a difference between the two groups (Taylor, 2006). This particular t -test is used when the data is normally distributed and when both samples have equal variance. To meet these assumptions, two statistical tests were carried out prior to the t -test. The Lilliefors test failed to reject the hypothesis that both the control group (p -value = 0.5000) and the experimental group (p -value = 0.4093) are normally distributed, and the Levene's test for equality of variances met the assumption of homoscedasticity ($f=0.6337$). This means that the scores from both groups are normally distributed and of equal variance. Having proved these assumptions, the p -value from the t -test (p -value = 0.0012) rejected the null hypothesis and indicated a statistical significance at the 1% level ($p < 0.01$). This provides a high probability that the performance of both groups (control and experimental) is different and that the EMS did improve student understanding regarding the effects of electrode misplacement.

As mentioned in the methodology, each student was provided a unique identification to access the EMS. With this information, the correlation between each student examination score and the number of times the student accessed the EMS is presented in Figure 6. There is, however, just a moderate correlation ($r = 0.477$) between these variables. Nevertheless, if the amount of time each student spent using the EMS was recorded; perhaps the correlation between duration and score would be higher.

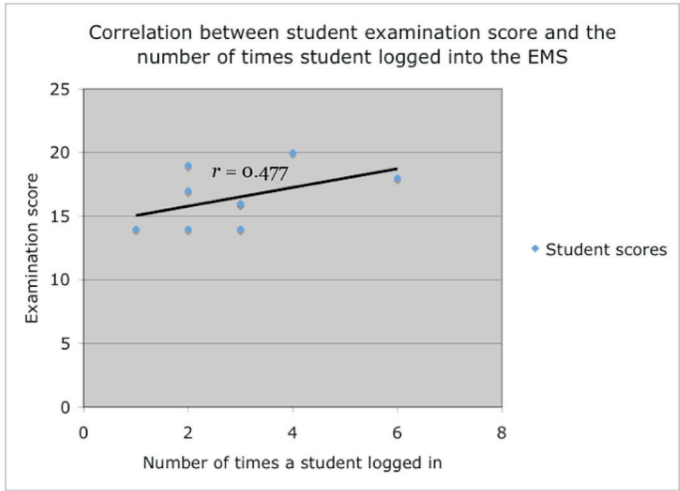


Figure 6: Scatter diagram of the correlation between student examination score and the number of times each logged into the EMS

Usability of the EMS

In the usability questionnaire, a number of questions were asked using a five point semantic differential scale (where 1 has a negative connotation and 5 a positive connotation). All nine students rated the usefulness of the EMS for educational purposes. They also rated its learnability, look and feel and the responsiveness of the system. The results of these questions (refer to Table 1) have been very positive.

Attribute	Mean rating/ standard deviation	Mode rating
Usefulness	4.6 ± 0.5	5
Learnability	4.3 ± 0.5	4
Look and feel	4.3 ± 0.5	4
System responsiveness	4.3 ± 0.7	4

Table 1: Results from four questions that use a five point semantic differential scale (where 1 = low and 5 = high).

Students were also asked a number of general questions. The answers to these questions can be viewed in Table 2. All nine students said that they gained knowledge from using the EMS and are now more aware of the effects of electrode misplacement. Six students indicated that they could learn how to use the EMS within minutes or hours and all nine students indicated that they could learn the features of the EMS without formal training of the software. All nine students indicated the colour scheme was suitable and that the layout was intuitive. The students also indicated that they would recommend the EMS and that they themselves would use the software again. Six out of the nine students indicated that the EMS could be improved for the purposes of pedagogy, i.e. it could be attached to a physical mannequin, which would allow a person to physically position the electrodes and view the resulting effects through the EMS software. Finally, seven out of nine students identified that they prefer to use medical software on the Web as opposed to the desktop.

Discussion

Although this paper discusses a multimedia simulation tool for teaching Clinical Physiology, a number of features from the study can be transferred to any domain. For example, the use of the Adobe Flash technology can be used in any domain to develop a multimedia learning tool. Flash is a favourable multimedia tool facilitating support for text, audio and video integration. It also has a powerful animation engine and facilitates interactive programming, which can, for example, be used to develop educational games.

However, one disadvantage to this technology is the lack of support on Apple products such as the Apple iPhone and iPad.

Another transferable feature in this paper is the methodology that was used to assess how effective the multimedia simulation is for improving student understanding. The methodology used is a basic form of a randomised control trial borrowed from pharmaceutical research (Taylor, 2006). However, this study did not include a 'placebo' group of students. For example, it can be argued that the experimental group performed better simply because they were given additional support and the fact the students knew they were

Question	Students who said No	Students who said Yes
Have you gained knowledge from using the EMS?	0	9
Could you learn how to use the EMS within minutes or hours?	3	6
Could you learn how to use the EMS without formal training of the software?	0	9
Is the colour scheme suitable?	0	9
Is the layout intuitive?	0	9
Would you recommend the EMS?	0	9
Will you use the EMS again?	0	9
Could the EMS be improved?	3	6
Do you prefer medical software to be on the Web as opposed to the desktop?	2	7

Table 2: Results from nine general questions

part of an experimental exercise. Therefore, perhaps they were under more pressure or even expected to perform better. As a result, it maybe beneficial to include a placebo as part of a future study. For example, this may include giving a random student sample access to an unrelated game with the bogus idea of gaining knowledge on a particular topic. However, the concept of a placebo in education maybe a far-fetched analogy to pharmaceutical research. Nevertheless, the fact students in the experimental group were given additional support is a limitation of the study.

Conclusion

In conclusion, the EMS was found to be both usable and a beneficial adjunct to the classical teaching of electrocardiology. This study supports the hypothesis that access to the EMS facilitates a better understanding of the ECG and the effects of electrode misplacement as evidenced through a class test. In general, this study justifies the

need and value of interactive tools and multimedia simulations to aid teaching in the field of Clinical Physiology and further afield. Work is currently being carried out to improve the interface and the usability of the EMS software. We also hope to gain the attention of an ECG book publisher who would append this software to their ECG textbooks.

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Dr Raymond Bond completed a BSc (Hons) in Interactive Multimedia Design and a PhD in Computer Science. He is a teaching fellow in the School of Computing and Mathematics and has research interests in health informatics, computerised electrocardiology, multimedia simulation and usability engineering.

Cathal Breen is a clinical specialist in the areas of diagnostic cardiology, specifically structural abnormalities of the heart using diagnostic imaging methods and heart rhythm abnormalities utilising electrophysiological techniques. Educated in Northern Ireland, Mr Breen has worked professionally in St Vincent's University Hospital Dublin, St Bartholomew's Hospital Trust London, St George's Hospital London and the Belfast Trust Northern Ireland. At present he lectures on the BSc Hons Clinical Physiology Cardiology programme, BSc Hons Healthcare Science (Cardiology) programme and BSc Health Physiology programme at Ulster. Mr Breen's research interest is in electrocardiography, innovative cardiology practice and cardiovascular risk in adults with chronic inflammatory diseases.

Dr Dewar D. Finlay was born in Northern Ireland in 1977. He received the B.Eng. degree in electronic systems and the Ph.D. degree in computer science from the University of Ulster, Jordanstown, U.K., in 1999 and 2006, respectively. He is currently a Senior Lecturer in computer science at the University of Ulster. His current research interests include medical devices, healthcare technology, and computerized electrocardiology.

Chris Nugent is Professor of Biomedical Engineering at the University of Ulster. He received a Bachelor of Engineering in Electronic Systems and DPhil in Biomedical Engineering both from the University of Ulster. His research within biomedical engineering addresses the themes of Technologies to Support Independent Living, Medical Decision Support Systems specifically in the domain of computerised electrocardiology and the development of Internet based healthcare models. He has published extensively in these areas with the work spanning theoretical, clinical and biomedical engineering domains.

Dr George Moore received both a Bachelor's degree and PhD in Computing from the University of Ulster. His recent research has focused on assistive technology to support independent living, with an emphasis on investigating mobile solutions. He also has expertise in user experience design and an interest in natural user interfaces. George Moore is an active member of the British Computer Society and a Chartered IT Professional.

Daniel Guldenring is a Computer Science PhD student at the University of Ulster. He received his Dip. Ing.(FH) degree in Electronics and Information Technology from the Hochschule Augsburg and MEng degree in Engineering from the University of Ulster. His research interests are digital signal processing and the biophysical modeling of the cardiac electrical activity.

Dr Galen Wagner attained his MD at Duke University and is currently affiliated with Duke University Medical Centre. He has published 349 articles and is the author of a prominent medical textbook, namely, «Marriott's Practical Electrocardiography» and is also the current Editor-in-Chief for the Journal of Electrocardiology.

Assessing the academic skills and needs of part-time undergraduate Criminology students

Rachel Monaghan, School of Criminology, Politics & Social Policy,
University of Ulster

Introduction

The following research was undertaken as part of the Professional Development through Higher Education Practice module on the Postgraduate Certificate in Higher Education Practice. Students enrolled on this module are encouraged to pursue a research project related to their academic work. As Course Director for the part-time undergraduate Criminology and Criminal Justice (CCJ) degree, a case study approach was adopted. The research project was designed to ascertain the academic skills-base that part-time undergraduate students studying criminology bring to their studies and to discover if they had any academic needs. Such information could contribute to the students' experience of part-time undergraduate study, potentially increase retention rates for the course and assist the Course Director in their capacity as Studies Advisor.

Context and literature review

There has been much talk of increased access and widening participation in higher education since the publication of the Dearing Report in 1997. Much of the focus has been upon full-time students at the expense of their part-time counterparts. Indeed, the existing literature and commentary concentrates on the issue of financial support and funding. As noted by Fazackerley et al., (2009, p. 3): "part-time students get a fraction of the financial support received by full-time students. They have to pay their fees up front, they can't take out a government-supported loan and their chances of securing any financial support are slim".

Debate and reference to part-time higher education is, as Davies (1999, p. 144) argues a 'negative voice' and "is usually a half empty' rather than a 'half full' version of the 'real thing' which is full-time".

Despite this, figures show that within the United Kingdom there were 861,260 part-time undergraduate students in 2009/10 and in Northern Ireland; part-time students represent some 30 per cent of the student population in higher education (HESA, 2011). More specifically, in 2010/11 33 per cent or 8,264 of the University of Ulster's student population were part-timers (University of Ulster, 2011).

Much of the existing literature on the subject of part-time students has focused on a particular theme, for example, the motivations of such students (Swain and Hammond, 2011), the benefits of part-time study (Bennion et al., 2010), the provision of part-time higher education (Universities UK, 2010) and part-time students' experiences (Williams and Kane, 2010). Additionally, there are a growing number of practical guides designed for the part-time student including the provision of study skills (Gattrell, 2006; Wilson and Bedford, 2009). What is largely missing from this picture is a consideration of the academic skills which part-time students may bring with them to their studies or are in need of acquiring. One notable exception is Sewell's (2000) research of part-time mature students' perceptions of skills at Birbeck, University of London.

Sewell's research involved a postal survey of 299 students from a student body of around 3,000 undergraduates to explore "students' perceptions of their life experiences, in terms of the skills they already possess, and the usefulness of these skills for study" (Sewell, 2000, p. 304). Of the 299 surveys sent out, 104 were returned and analysed. From these Sewell found that a considerable overlap existed between "the stated skill-base of the students and the skills perceived as useful for study" such as essay-writing and oral presentations (Sewell, 2000, p. 313).

Methodology

As already noted, the research adopted a case study approach. Such an approach Bryman (2004, p. 54) suggests promotes the value of detailed analysis thus "the case is an object of interest in its own right and the researcher aims to provide an in-depth elucidation of it". For case study methodologists such as Yin (2003, cited in Gray, 2010) it is impossible to understand the topic of study by

merely examining abstract statistics produced by survey work, one must also know the background within which the data was gathered. Subsequently, a mixed methodology involving both quantitative and qualitative methods was utilised to gather sufficient data for analysis. A self-administered questionnaire to consider existing skills and potential academic needs of part-time Criminology students was designed. Initially, it was envisaged that the sample population would only include part-time CCJ students of which there were 27 registered across all years but a small number (7) of these were on leave of absence or presumed withdrawn from the course resulting in an initial sample population of 20. Given the potentially small sample population, the sample was extended to include part-time Criminology Minor students (15). Thus, the sample population for the questionnaire was 35 part-time Criminology students.

The questionnaire involved ten questions asking about the respondent's prior academic study, their experience/possession of academic skills, whether these skills had improved, stayed the same or deteriorated since commencing their university course and what skills, if any, they would like to improve. Respondents were presented with a fixed range of responses and were asked to merely tick those boxes which applied to them. The penultimate question was open-ended and allowed for participants to elaborate upon their answers. Issues of anonymity and confidentiality were explained to the students in the questionnaire's preamble.

Preliminary discussions with the student cohort under study suggested that a postal survey as opposed to an electronic one would yield a potentially higher response rate as some of the students concerned did not have internet access at home. The questionnaire was sent to students' home addresses with a pre-paid envelope for its return. Additionally, students were emailed to return their questionnaires in a timely manner in an attempt to increase the response rate.

The research also involved a qualitative element, namely semi-structured in-depth interviews. Originally five such interviews with new part-time students were proposed. The last question on the questionnaire asked for those students who would be willing

to be interviewed to make themselves known via email. Whilst eighteen students indicated a willingness to be interviewed only nine interviews were conducted due to the availability of students. A semi-structured interview schedule was designed to gain a greater insight into the academic skills and needs of part-time Criminology students and their experience to date and included questions on academic skills, induction and their knowledge of student guidance within the University.

Findings of the Study

In terms of the quantitative element of the research, 28 out of 35 questionnaires were returned, a response rate of 80 per cent, this was significantly higher than Sewell's (2000) survey of part-time undergraduates, which yielded a response rate of only 35 per cent. This may be due to the researcher's personal knowledge of the students and their position as Course Director. The average age of respondents in the August prior to commencing their current course was 37. A breakdown of ages is provided in Table 1.

Age	No. of students
21-25	2
26-30	1
31-35	9
36-40	5
41-45	5
46-50	3
No response	3

Table 1 – Age of part-time Criminology undergraduates in the August prior to starting their course.

The gender distribution of respondents was exactly half male and half female. In terms of employment status, 23 students were in full-time employment, 1 in part-time employment and 4 not in employment. Eighteen were in the first year of their studies, eight in their second year, one in their third year and one student did not state which year they were in.

In terms of the highest educational qualification obtained prior to commencement of their criminology degree, the students in the survey possessed a range of qualifications including O levels or their equivalents (2), A levels (6), HNC/HND (18) or a postgraduate or first degree (2). Given that more than 93 per cent of respondents had post-compulsory education qualifications and that 71 per cent of these were gained in the further or higher education sector it was not, therefore, surprising to find that the majority of respondents possessed or had experience of a range of academic skills prior to the commencement of their current course of study (see Table 2).

	Possessed/ Experience of (%)
Analytical skills	68
Absorbing information	79
Self motivation/drive	93
Using your initiative	93
Communication skills/oral presentations	89
Planning your work/organizing your time	89
Numeracy	43
Writing skills	71
Working independently	86
Working with other people/in teams	96
Self-confidence	61
Computing/IT skills	75

Table 2 – Possession or experience of academic skills prior to starting current course.

This was also reflected in the qualitative interviews:

“The A levels I had taken had nothing really related to the degree but the skills of essay writing...I had picked up in A levels could be put to use. I feel they always stay with you; they may get a bit rusty.”

“I completed a HNC and that was really what brought me up to speed with my study skills as far as assignment writing...I would’ve had research, answering questions, essay writing, we covered presentations...”

Students were also asked whether they thought their academic skills had improved, remained the same or deteriorated since the commencement of their studies. The results from this question varied according to the academic skill under consideration as can be seen in Table 3.

	Improved (%)	Stayed the same (%)	Deteriorated (%)
Analytical skills	52	48	
Absorbing information	69	31	
Self motivation/drive	54	46	
Using your initiative	37	63	
Communication skills/ oral presentations	44	56	
Planning your work/ organizing your time	54	38	8
Numeracy		95	5
Writing skills	65	35	
Working independently	38	62	
Working with other people/in teams	26	70	4
Self-confidence	52	48	
Computing/IT skills	31	69	

Table 3 – Students’ perceptions of their academic skills level since starting their course.

From the interviews with students, it was clear that they believed that some of their academic skills had improved:

“Yes greatly, certainly as far as assignments yes very much so, wording, vocabulary, the whole thing has improved...it’s taken up a notch you have to I suppose, from the first year receiving positive feedback about assignments and bibliographies that kind of thing.”

“Yes. I feel that I am becoming more adept at considering and evaluating information. I am able to identify and effectively communicate key issues in relation to a specific subject area.”

Students were asked what skills, if any, they would like to improve, again the results varied as illustrated in Table 4.

	Improvement/ sought (%)
Analytical skills	43
Absorbing information	68
Self motivation/drive	32
Using your initiative	29
Communication skills/oral presentations	43
Planning your work/organizing your time	64
Numeracy	29
Writing skills	61
Working independently	25
Working with other people/in teams	29
Self-confidence	54
Computing/IT skills	32

Table 4 – Academic skills where improvement was sought.

This was also apparent whether there were any academic skills that they needed to improve upon:

“Yes, I need to improve in many areas including critical analysis of course materials and the presentation of reasoned arguments.”

“I feel the grammar and presentation side of my essay writing needs improvement.”

Students were also asked during the interview if they were aware of the student guidance and support services available to them – the majority of respondents said they were not aware of either Student Support or the Student Union’s provision even though such services are mentioned in the course handbook and at induction. Those students who had attended an induction session felt it was “rushed” and “confusing” as part-time students were present at the same induction session as their full-time counterparts and much of the information given in terms of student loans, progression and fees was not relevant to part-time students. Indeed, the provision of differing information in respect to full-time and part-time students workloads, for example, maximum number of modules and what modules to enrol on further added to the confusion experienced by some part-time students. However, the idea of a separate induction session for part-time students was viewed positively by respondents:

“I think induction would be an essential thing for part-time students to make them aware of what happens and what they need to do especially for those that have been out of education for a while. That would be a key thing, making them aware of student support services...”

Analysis and discussion of the findings

The demographic characteristics of part-time undergraduate Criminology students and the qualifications they held prior to commencing their studies at the University differ somewhat from those found elsewhere in the United Kingdom. Universities UK (2010, p. 6) found in terms of the HESA Student Record for 2007/08 enrolments that “part-timers are typically older, more likely to be female and more likely to hold vocational qualifications or general

education qualifications below A level on entering education courses”. According to the HESA Student Record 2007/08, 61 per cent of part-time students in higher education studying for a first degree were female whereas for part-time Criminology students, the figure was 50 per cent. The research also found that 71 per cent of respondents had experience of further and/or higher education prior to the commencement of their undergraduate study in Criminology compared to a national figure of 43 per cent (Universities UK, 2010, p. 21). This mirrors the finding of Little et al (2005, p. 10): “part-time students are likely to have a wider range of entry qualifications than full-time students, including previous higher education qualifications and professional qualifications”.

Interestingly, Sewell does not provide any demographic characteristics of the students who participated in her research or the highest level of qualification they held prior to commencing their studies.

In terms of the level of highest previous educational qualification obtained a number of differences can be noted between the current study and the HESA Student Record for 2007/08 as illustrated in Table 5.

Qualification	HESA Student Record, 2007/08 (%)	Part-time criminology students (%)
Masters or first degree	14	7
Foundation degree	1	0
HNC/HND	13	64
Other HE qualifications below level 4	18	0
A levels/AS levels	26	21
O level/GCSE/GCE	19	7
No formal qualifications	2	0
Not known	6	0

Table 5 – Level of highest educational qualification attained before starting part-time degree.

Thus many part-time Criminology students have experience of higher and/or higher education before commencing their undergraduate degrees; this in part explains the high percentage of students who indicated possession or experience of academic skills outlined in Table 2. Such a finding is consistent with Sewell's (2000) work on mature part-time students' perceptions of skills.

Student guidance and induction were identified as key issues for part-time students. Cottrell (2001, p. 66) noted that "induction left students more confused and anxious than they were previously, lost in a sea of undigested information that lacked frames of reference to make it meaningful". This was a view echoed by some of the part-time Criminology students who had attended an induction session.

Next steps: a way forward

As stated at the outset part of the rationale for the study was to contribute to the students' experience of part-time undergraduate study, increase retention rates for the courses concerned and to assist the Course Director in their duties by identifying areas of concern for part-time students such as induction, student guidance and an awareness of the skills that part-time students sort to improve. From interviewing the students it became apparent that better signposting of available information was needed. To this end, course resource areas were developed in WebCT (now in Blackboard Learn) for both the CCJ degree and Criminology Minor programme. These areas house current course handbooks, module outlines, timetables, links to the Student Union welfare services and University's Student Support. They also incorporate a calendar function with details of guest lectures and talks, discussion boards allowing students to communicate with others on their course and links to study skills resources on the internet.

Other developments to note are the development of a specific semester 1 level 4 module on the CCJ degree entitled Studying Criminology, which aims to provide many of the skills identified by part-time students in a workshop setting including writing skills, time management and communication skills. Whilst academic skills are embedded within the other modules at level 4, the course team felt that a specific module on study skills would be of benefit. This

module was introduced in 2010/11 as part of the wider embedding study skills development in the first year curriculum. All part-time students are encouraged to take this module in their first semester of study regardless of their academic backgrounds. For those students returning to education after a lengthy absence, the module introduces them to the skills required for undergraduate study. For those students who already possess recently acquired study skills, the module aims to consolidate their skills base. Qualitative feedback from part-time students was provided to the module co-ordinator and reflected their positive experience of the module:

I have developed new skills that I will carry on with me throughout university such as critical thinking, how to reference and write a bibliography and also I have developed team work and leadership skills through the presentation task and the feedback I received I will use to correct further mistakes.

The module was useful in providing a clear and well constructed objective – ‘learning’ how to study at university. This, like any other skill or competence, has to be learned. The library induction gave an excellent overview of the facilities offered and the tools available online – as a part-time student this was very important.

Due to an increase in the number of part-time students (22) enrolling in 2010/11, the course team were able to provide a specific workshop allocated to part-time students only, this the course team believes provided an ideal opportunity for part-time students to meet other new part-time students and helped the group to bond as a cohort. Research elsewhere has shown that part-time students can experience marginalisation (Williams and Kane, 2010) and loneliness (Gatrell, 2006). Many of the part-time students who took Studying Criminology reflected in their feedback on their experience, that the module was a good way “for getting to know peers” and for “mixing and meeting people”. In terms of retention, a number of observations can be made. Of those part-time students who successfully completed the Studying Criminology module, only two students later withdrew from the course. In relation to the other early leavers, two had withdrawn voluntarily by week 6 of semester 1 and three students were withdrawn by the course team for non attendance. Comparisons to previous years are difficult to make

as the intake of year 1 students has been considerably smaller, for example, in the year previous to the introduction of the new module 2009/10, the intake was only eight students with three early leavers.

Additionally, part-time CCJ students were inducted separately from their full-time counterparts in September 2011; the information provided by the Course Director was specific to part-time students, for example financial assistance from Student Finance NI, guidance in relation to the completion and submission of PTG1 forms applying for financial assistance, minimum/maximum number of modules per academic year and length of time it would take to complete the degree. Additionally, a staff member from Student Support attended the first workshop for Studying Criminology and provided information of the service they offer.

What is clear from the research is that part-time undergraduate Criminology students are not a homogenous group; they bring with them a variety of prior certificated learning and possess a broad range of academic skills. The development of the Studying Criminology module has meant that all CCJ students whether part-time or full-time are provided with the study skills required for the degree at an early stage. As a course team we are continuing to monitor students' perceptions of this module and subsequent student progress.

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Rachel Monaghan is a senior lecturer in Criminology and has been the Course Director for the part-time Criminology and Criminal Justice degree since 2005.

An Evaluation of the Impact of Widening Access Skills in Primary Schools (WASPS) Initiative

Sandra Moffett and Mairin Nicell, School of Computing and Intelligent Systems, University of Ulster

Introduction

The Widening Access Skills in Primary Schools (WASPS) initiative was established in 2009 by the School of Computing and Intelligent Systems (SCIS) at the University of Ulster to develop pedagogical skills in Science, Technology, Engineering and Mathematic (STEM) subjects, with children aged 10-12 years. Engaging with young people in a fun and exciting way from an early age should encourage them to think positively about STEM (Burghes, 1998), sparking interest in studying computer orientated subjects in secondary education and beyond. Over a three year period (2009–2012) a total of twelve schools (four per year) participated in a series of ‘hands-on’ practical workshops to develop a topical advertising campaign.

This paper presents how the WASPS programme has stimulated interest in STEM subjects with primary school children. The paper commences by outlining the need for young people to take an interest in STEM, and why education is needed to promote growth of UK economy in STEM areas. A sample of educational projects which have been used to promote the STEM agenda is outlined. The paper continues by describing the University of Ulster’s STEM focus, introducing WASPS as one of its current initiatives. The project programme is described and results of evaluation presented, reflecting on the impact of WASPS and the benefits/limitations of the project.

Project background

In January 2009, a whitepaper documenting ‘The Demand for Science, Technology, Engineering and Mathematics (STEM) Skills’ was launched in the UK (Department for Innovation, Universities and Skills, (2009). This report concluded that UK employers often report difficulties in recruiting STEM qualified staff perceiving a shortage in STEM skills, resulting in unpredictability of future STEM

industry development. These findings are supportive of the e-skills IT and Telecoms Insights (2008) which claimed that while the IT industry was buoyant (projections to 2012 estimated that 141,300 new entrants to the workforce will be required each year to replace both existing workers and meet expansion needs) companies stated difficulty in attracting IT graduates, with larger organisations citing quality of applications received as a contributing factor. Even when applicants possess sufficient skills to secure a job, new recruits often have skills shortfalls, with 70% lacking technical skills, 30% business skills and 31% interpersonal skills (e-skills, 2008). In 2008, the Institution of Engineering and Technology (IET) reported a similar story (IET, 2008).

Wilson, (2009, p.10) outlined that “the falling shares of young people choosing to study STEM subjects has been cause of concern” with a number of official reports confirming lack of numbers of young people following STEM educational routes through Further Education and Higher Education, and onto Science, Engineering and Technology occupations, see Royal Society, (2008) and Smith, (2007) for examples. To entice young people to study STEM subjects a number of educational programmes have been developed; a sample of which are presented below:

National Science and Engineering Week (NSEW, 2012) (<http://www.nationalstemcentre.org.uk/elibrary/collection/1195/national-science-engineering-week>)

Promoted by the British Science Association, the annual National Science & Engineering Week (NSEW) aims to celebrate all sciences and their importance in our everyday lives. It provides an opportunity for people of all ages across the UK to take part in science, engineering and technology events and activities. The theme for 2012 is ‘World in Motion’.

Looking Ahead: STEM Careers Videos (<http://www.nationalstemcentre.org.uk/elibrary/collection/605/looking-ahead-stem-careers-videos>)

Careers4u.tv is a library of video case studies designed to expand students’ horizons, excite them about their future working lives and motivate them to obtain the skills and qualifications needed to

achieve their goals. Each case study interview looks at a different STEM-related career. They cover what the job entails, the skills and training needed and possible career progression paths. Each one is also accompanied by teachers' notes.

BringITon (<http://bringittonni.info/>)

Bring IT on is a Northern Ireland based STEM promotional campaign, using media such as television, the internet and interactive workshops to promote IT careers to young adults. A wealth of information can be found on its website, tailored for teenagers, parents, adults and industrial professionals.

University of Ulster STEM focus

The University of Ulster has an international reputation for excellence, innovation and engagement in STEM based areas, evidenced by high Research Assessment Exercise (RAE) results in 2008, where the Computer Science Research Institute was listed 15th in the UK national league table for research excellence; the Engineering Research Institute was listed 11th, and Biomedical Sciences came top in the UK, to name but a few examples (http://research.ulster.ac.uk/rae/RAE2008_Results.html). On the Magee campus, further evidence of STEM excellence is noted in creation of the Intelligent Systems Research Centre <http://isrc.ulster.ac.uk/>) and the recent announcement by Vice Chancellor, Professor Richard Barnett, that the student body on the Magee campus is set to increase by 1,000 additional full-time undergraduate STEM students, plus another 1,000 part-time students (<http://www.ulster.ac.uk/northwestdevelopment/north-west-campus.html>). While this news is welcomed by the School of Computing and Intelligent Systems (SCIS), attracting students to STEM subjects is challenging (Smith, 2007; Wilson, 2009).

SCIS appreciates the importance of engaging with potential students to attract them to its courses, with much effort awarded to participating in numerous career events, school visits, placement opportunities and promotional activities each year. Appreciating the need to excite younger people about STEM subjects, SCIS offers several programmes, such as the SCIS Seagate Summer School, First Lego League competition, Plan Bee, Computing Skill

Workshops, the Widening Access By Introducing Programming in School (WABIPS) and WASPS.

The remainder of this paper focuses on the WASPS programme, funded by the University's Access Agreement. The WASPS aims to develop pedagogical STEM skills and transferable skills in children aged 10-12 years. The project complements the Revised Northern Ireland Primary Curriculum for Key Stage 2 in two areas of learning; Arts (creative design) and The World Around Us (technology and business)

(http://www.nicurriculum.org.uk/docs/key_stages_1_and_2/northern_ireland_curriculum_primary.pdf) and Thinking Skills and the Personal Capability Framework where a number of transferable skills, such as managing information, problem solving and decision making, being creative, working with others and self-management are assessed (http://www.nicurriculum.org.uk/key_stage_3/skills_and_capabilities/thinking_skills_%20personal_capabilities/).

The programme

The aim of WASPS is to provide the opportunity for participating pupils to enhance their skills set in terms of conceptual, creative, marketing, computational, communication and presentation skills. At the beginning of each year, pupils from participating schools attend a launch ceremony, where facilitators (SCIS staff members) are introduced and the project is explained. In consultation with teachers, pupils are organised into small groups (4/5 pupils) to undertake a team-project to develop a topical advertising campaign. Participants attend the Magee campus one half day per month for workshop participation. The first workshop focuses on idea generation resulting in a storyboard from each group on their advertisement theme, the second workshop teaches pupils to animate characters from images, photographs, media clips, adding visual and audio features for speech and movement, the third workshop takes the animated characters and builds a short movie clip for advertisement presentation.

Between each visit to Magee contact is maintained by SCIS facilitators visiting the schools regularly. This ensures relationships with the schools are maintained, fostering close links for the future. At the end of the project an awards ceremony is held. Prior to this

event, each campaign is judged by a panel of external personnel using an established set of criteria, based on idea formation, team work, leadership, communication and standard of work achieved. Prizes are awarded to the one winning team and three runners up, based on overall criteria scores. There is also an overall school prize for commitment and effort. The awards ceremony provides the finale to the project; certification and refreshments are provided to all pupils while winning teams are rewarded with prizes suitable for the age group, such as ipod touches, books, pencils and personalised mugs. The aim of the ceremony is to encourage competition amongst the groups giving pupils a final event to work towards for display and publication of their work.

Evaluation methodology

Participating pupils were a mixture of girls/boys with all ranges of abilities, from all sections of the community. A total of 365 pupils and 16 teachers from 12 schools have been involved in the project.

To gain insight into experiences of those involved, and to ascertain success of the project, SCIS facilitators conducted qualitative/quantitative analysis. Quantitative evaluation was undertaken with ten (62.5%) teachers in the form of a short questionnaire. Qualitative evaluation is conducted throughout the lifecycle of the project with pupils and teaching staff using techniques such as interviews, observation and informal conversations; feedback is also used to improve the work programme as necessary. At the end of the project a sample of pupils (n=28, 8%) were selected at random and invited to participate in focus groups to reflect on their experience of taking part in the project. The decision to employ focus groups to elicit qualitative data from this range of pupils was inspired by The Child Poverty Needs Assessment Toolkit (<http://www.idea.gov.uk/idk/aio/22530625>) which presents a range of techniques for engagement and collaboration of young people. An information sheet and consent form was sent home with each child selected to take part in advance of the evaluation study and written consent was gained from their parents.

Evaluation results

Evaluation results are formulated around the University's four key strategic teaching and learning principles. Ten teachers and

twenty-eight pupils provided feedback on the project. The teachers were presented with a short questionnaire to gain a general overview of the project elements. All questions in the questionnaire were scored positively (Figure 1) with equal importance awarded to each category (Figure 2). Follow-up interviews with the teachers were conducted on a one-to-one basis, qualitative comments are provided in table 1, column 2. Pupils involved in the evaluation provided their comments in focus groups, this enabled a debate around project elements to take place, making the children more relaxed and forthcoming with their evaluation comments, these are provided in table 1, column 3. Table 1 also contains reflective comments from the WASPS team (column 4).

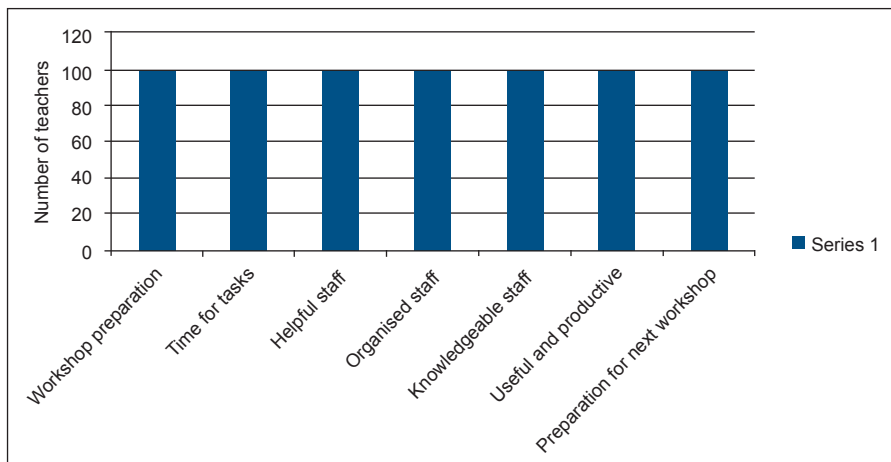


Figure 1: 100% positive results

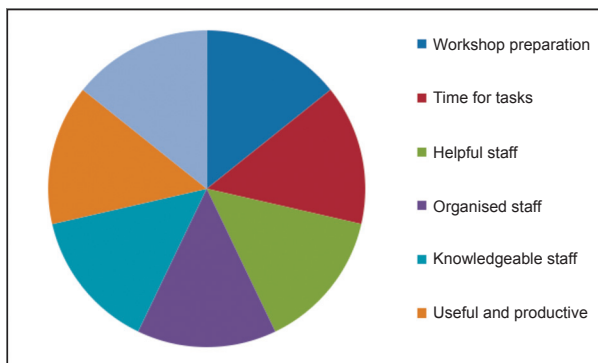


Figure 2: All items equally important

Teaching and Learning Principle	Teachers Comments	Pupils Comments	Team Responses
To enhance the quality of the student learning experience	<p>'Being involved in the WASPS project has been an honour, never before have we been included in such an interesting and fulfilling project, the children are delighted with how the project went'</p> <p>'Our school has never been invited to Magee before, which is a shame as this is a great facility on our doorstep, thank you for the kind invitation to take part in WASPS'</p> <p>'The whole experience was great. Would I do it again, definitely'</p>	<p>'WASPS is awesome'</p> <p>'With WASPS everything was great, better than great! It was just a really good experience'</p> <p>'I think WASPS was probably the best thing I've ever done at school'</p>	<p><i>The aim of WASPS was to develop creative and technical skillset of participating pupils in an innovative, fun and stimulating way</i></p>
To target, recruit, support and retain a diverse range of students	<p>'WASPS is a great project which caters for all ranges of abilities'</p> <p>'The launch day was an excellent introduction to the WASP project. The only improvement I believe could be made was the interaction between schools. It is a cross-community project but as such the children did not get to 'work' with the other schools. Perhaps during the Arts and Crafts activity the children could have been mixed to get to know each other'</p>	<p>'I would like to do computing at university, because it's fun, and it might help you in the future'</p> <p>'I would like to do it (study computing), because see if this project was still on, then I would I be able to experience what you have experienced with children. And you would earn money, and money's good'</p> <p>'Going to Magee was exciting... that was our first time going to University ... I can't wait to go when I am older'</p>	<p><i>WASPS is suitable for all P6/7 pupils, it caters diversity including disabled pupils, and those with learning disadvantages.</i></p> <p><i>While the aim of WASPS is not necessarily to promote the cross-community agenda, this point has been noted and schools from different denominations are now encouraged to interact more</i></p> <p><i>WASPS is part of a longitudinal study to encourage young people to study STEM subjects, further events are planned with participants when they are older to build relationships with them and encourage them to attend University</i></p>
To promote and foster creativity and innovation in curriculum design and delivery	<p>'I will be using the software with other groups for years to come, I have learnt loads myself and am grateful to have been included in the WASPS project'</p> <p>'The WASPS project, which was supported so enthusiastically and purposefully by staff from the University of Ulster has been a most stimulating and satisfying learning experience for us all and we are totally overwhelmed to be the winning school and greatly appreciate your investment in [name of school]'</p>	<p>'I loved using Crazytalk, it was fun being able to animate our characters, getting them to talk in our voices while they moved their eyes and mouths, real cool'</p> <p>'The work we did in WASPS was fun, it was not like school work, I really enjoyed all that I learnt'</p> <p>'I didn't think I was good at art and stuff, but now I can do it cause I know how to plan, draw it out [storyboarding], see it on paper then do it on the computer, it's easy when you know how'</p>	<p><i>WASPS is designed to complement the Northern Ireland curriculum in terms of creativity and innovation. Software tools are employed to engage with pupils in a novice, interesting and fun way</i></p>

<p>To promote learning, professionalism and employability through the integration of academic theory and relevant practical and vocational practice</p>	<p>'Again the help was excellent. We had a thousand questions which were all explained in great detail, a very beneficial morning'</p> <p>'as always the workshop was superbly organised. The children got lots of songs downloaded and are very excited about importing them onto moviemaker. Thanks again for everything.'</p> <p>'When the Principal informed me about the project and that he had agreed my class would take part, I was worried and not really keen [not being a big fan of technology myself]. I felt out of my depth but soon realized I had nothing to worry about. In Magee the staff ran the workshops wholeheartedly, I just sat back, relaxed and enjoyed the experience. Soon my confidence grew and I was able to help out as well'</p>	<p>'Using moviemaker made you feel like you were working in Disney, I would like to be a film maker when I am older'</p> <p>'My dad works with computers, I now want to do the same'</p> <p>'Coming to Magee has made me want to study computers when I am older'</p> <p>'I hope you's run more events like this, I would love to do more of this type of thing'</p> <p>'I am definitely up for doing WASPS again, I loved it, my little sister is hoping to do it next year when she is in P6, then I could help her'</p> <p>'I am definitely coming to Magee when I am 15!'</p>	<p><i>Both teachers and pupils fully engaged in the project in a professional manner. Teachers were very complimentary about the service they received from University staff</i></p> <p><i>Teachers and pupils learnt new skills by practical application both within the University and within the school environment</i></p> <p><i>It is great to hear that participants would consider coming to Magee in the future, are interested in studying computing, and are willing to engage in further workshop based events</i></p>
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Table 1 – WASPS Evaluation Feedback

Both teachers and pupils agreed that WASPS provided a positive student learning experience (teaching and learning principle 1). While the aim of WASPS was not to directly recruit students (due to the age of participants), the project did target, support and retain a diverse range of students (teaching and learning principle 2). All levels of ability were catered for including disabled children, those with learning difficulties, those from ethnic and socially disadvantaged communities. Content included in the WASPS programme promoted and fostered creativity and innovation in its curriculum design and delivery (teaching and learning principle 3). Pupils found the work very engaging and fun while teachers stressed that skills were being developed which complimented classroom activity. As the WASPS content was very task oriented, learning was promoted through relevant practice (teaching and learning principle 4). Skills developed were suitable for the target audience range, and again while not directly applicable to recruitment and employability the project did encourage pupils to think about higher education and possible computing careers when they are older.

Delving further into teaching and learning principles 1 and 3, reflecting on how WASPS provided a *positive learning experience* and *promoted creativity and innovation in its curriculum design and delivery* the pedagogical development of WASPS content was compared to the Northern Ireland Curriculum criteria for assessment of Information Communication Technology (ICT) skills at Key Stage 2 level [13]. Table 2 outlines how the WASPS programme complements the ICT curriculum. Column 1 highlights key themes which should be addressed for ICT development while column 2 presents the criteria against which pupils are assessed in schools. Column 3 shows how WASPS content matches this criteria by samples of application and column 4 presents views from pupil on how they have met the criteria. Pupils' comments are derived from the focus groups presented earlier in the paper.

Theme	Criteria	WASPS	Pupil view
Explore	<ul style="list-style-type: none"> • access and manage data and information • research, select, process and interpret information • investigate, make predictions and solve problems through interaction with digital tools • understand how to keep safe and display acceptable online behaviour 	<p>save data sources to USB pens and hard drives applying file structures/management, recall data for use</p> <p>explore relevant sources to select appropriate images for animating, research relevant content on campaign topic, interpret and summarise information</p> <p>use a range of tools, such as crazy talk, moviemaker, powerpoint to plan, predict and make project outcomes</p> <p>at the beginning of the workshops pupils were informed of the University acceptable use of computing equipment, no-one violated this or attempted to access unsuitable material</p>	<p>'I used to throw everything onto my desktop, now I know how to save using files, it makes it much easier to find everything'</p> <p>'we kept changing our minds on what to include in our movie, you would find a good image, animate that, think you were finished, then a better image came along, so you started over again'</p> <p>'when we did computers in school all we did was work, but when we did Crazytalk, I learned. I was surprised it was so good. You could get a picture and make it talk. I didn't think in computers you could do something like that.'</p> <p>'The fact it was hard, made it better, I feel really proud that I finished it and learnt loads'</p>
Express	<ul style="list-style-type: none"> • create, develop, present and publish ideas and information using a range of digital media • create information and multimedia products using a range of assets 	<p>pupils have to create, develop and publish their campaign ideas in a movie which contained animation, they used storyboards for planning and powerpoint for final presentations</p> <p>outcomes from each team included storyboards, animated characters incorporated into a movie, powerpoint presentation, researched topic presented in an informative, interesting way</p>	<p>'it was cool to see how our original ideas looked in the movie, you would not have thought the end results would be so good when it was all pulled together'</p> <p>'when I showed my mum the movie she was amazed, she keeps telling everyone I could work in tv, it's so embarrassing but I am dead chuffed with what I can do'</p>
Exchange	<ul style="list-style-type: none"> • communicate using a range of contemporary methods and tools 	<p>final movies incorporated text, speech, voice recordings, animation, images, music and photographs</p>	<p>'we all had a role to do in the team, as well as developing our characters each, we had to talk to each other all the time to make sure the work was getting done'</p>

	<ul style="list-style-type: none"> • share, collaborate, exchange and develop ideas digitally 	each team had a USB pen and hard drive folder, they had to work together to ensure all items were saved and updated after each session, the final movie incorporated all the work of each individual	'we lost all our work on the hard drive and had to work extra hard to get it all back from the wee pens and school laptops. It was actually good cause it (the movie) ended up better than it was the first time! It taught us to save everything over and over'
Evaluate	<ul style="list-style-type: none"> • talk about, review and make improvements to work, reflecting on the process and outcome 	a team leader was nominated by team members at the beginning of the project, the leader's role was to collaborate with all team members, getting them to communicate their views and work progress regularly	'after each workshop in Magee we got together and talked about how much work we got done, Leah (team leader) kept us all organized ... but she did get very bossy towards the end'
	<ul style="list-style-type: none"> • consider the sources and resources used 	pupils were encouraged to carefully consider sources for the information they were going to use, for example to select images of a suitable size and nature	'we wanted two characters to talk to each other in the movie, we had to pick ones with their mouths closed as they work better in Crazytalk, then we had to think of the talking, what each one was going to say to the other'
Exhibit	<ul style="list-style-type: none"> • manage and present their stored work 	Each team was responsible for managing their own project. During judging day each team presented their work to a panel of assessors	'I enjoyed presenting our work, though we were nervous when the judges came to school. We also presented it at assembly and to our parents'
	<ul style="list-style-type: none"> • showcase their learning across the curriculum 	Each school was encouraged to develop ICT skills of the children further by incorporating animation and movie skills introduced in WASPS to other school projects. A copy of software used was presented to each school to facilitate cross curriculum knowledge transfer	'Now that Mr X (name of teacher) knows how to use Crazytalk, he is letting us use it in our Science project to animate some of the lab stuff we have, we are going to take photos and animate them'

Table 2 – ICT Key Stage 2 criteria match

Through the WASPS project pupils were able to explore, express, exchange, evaluate and exhibit their ICT skills. The rich learning environment of WASPS enhanced their ICT curriculum development, leading to further stimulation of STEM in a fun way.

Impact

By establishing relationships with schools, making pupils aware of University facilities and provisions, these pupils may be encouraged to undertake higher education at a later stage. Getting to know primary school pupils provides opportunity to maintain contact as they progress to secondary education. Follow up workshops are planned for participants when they are aged 13/14, giving them an advantage for undertaking SCIS summer school. It is hoped that some of the pupils involved in WASPS will eventually undertake tertiary level education. Based on the numbers involved in the overall project, if ten percent were interested in STEM undergraduate degrees, this would generate 37 new students, however if this project makes a difference to one child's future it has been worth undertaking. While WASPS in itself has been successful, overall impact will be measured when WASPS pupils choose to enter higher education, whether they opt for STEM based

courses, whether they choose to attend the University of Ulster, whether WASPS contributed to their decision making. At this stage, numerical data will show the real benefit of this project.

Conclusion

WASPS is an innovative initiative to encourage local primary school pupils to enhance STEM skills by undertaking a facilitator-led, topical project. WASPS content complements the Northern Ireland ICT curriculum for Key Stage 2, enhancing ICT skill development and transferable skills. It also contributes to the University of Ulster's STEM agenda, falling with SCIS remit of providing innovative and interesting programmes to stimulate interest in ICT, adding to the profile of events such as Plan Bee and the Summer School. The widening access agenda of the University is also targeted by this initiative, reaching out to young people, making them aware of the University and third level education, especially in STEM areas. By planting the idea that a career in STEM would be a viable option to the young people involved, the project also contributes to national policies regarding STEM education for STEM careers, and could be promoted under this umbrella in a similar vein to National Science Engineering Week and BringITon. As WASPS is part of a longitudinal study to promote STEM and University Widening Access, the true impact of the study will not be available for several more years. In the meantime, success can be measured by the positive impact WASPS has had on participants, the level of interest it has had beyond schools involved, and the notion that relationships are being formed with young people who may be future University of Ulster graduates.

The WASPS project has been a great success for SCIS. The standard of work from pupils involved was exceptional; all children embraced the project wholeheartedly and rose to the challenge. The WASPS project was like a 'breath of fresh air' for staff involved and to see such young children applying digital creative skills is very encouraging for the future of ICT.

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Dr Sandra Moffett is Principal Investigator of the 'Widening Access Skills in Primary Schools' (WASPS) project, and Fellow of the Centre of Higher Education Practice.

Mairin Nicell is co-investigator on the WASPS project. She is involved in the wiCADET, 'Widening Access through Computing Apps Development Training' programme, and co-investigator in two CHEP-funded projects (IN-TUNE, Investigating Transition to Undergraduate Education' and STIR, Socialisation to Improve Retention).

Degree classifications: worth the weight?

Michael Pogue, Gillian Armstrong, Peter Green, Gregory McGrath,
Department of Accounting, University of Ulster

Introduction

The current method of classifying degrees in the UK is the Honours system introduced in Oxford at the beginning of the 19th century. Universally UK higher education institutions apply identical nomenclatures to their first degrees (First Class, Upper Second, Lower Second and Third Class) but, despite this apparent degree of standardisation, considerable variation is evident in both the incidence of classifications awarded across institutions and also across degree disciplines (Curran and Volpe, 2002; Yorke et al., 2008). In addition the steady improvement in degree classifications since the Higher Education Statistics Agency (HESA) began to publish data in 1994-95 has prompted allegations of grade inflation and an associated slipping of standards.

Whilst various quality initiatives have been forthcoming with the objective of encouraging comparability across institutions (subject benchmarks being a notable example), it is clear that the institutional variation in degree classification is contributed to by a wide range of algorithms utilised to establish degree classifications. Identification of the underlying explanation for grade inflation is more problematic with a myriad of variables (including teaching quality, student diligence, increased usage of coursework and institutional league tables) all potentially impacting upon the upward trend in “Good” (First /Upper Second Class) Honours degrees (Yorke, 2009).

In addition, the impact of the classifications awarded has significant implications for both the recipient and potential future employers. For the recipient the achievement of a “Good” degree has future ramifications in relation to both potential employment and available avenues for further study with a recent report suggesting that 78% of employers currently require applicants to have an Upper Second Class degree (Association of Graduate Recruiters (2010). Furthermore the potential employer relies upon degree classification as a robust signal regarding the academic competence of an

applicant. For both of these stakeholders inconsistencies in the algorithms used to establish degree classifications raise issues of equitability and reliability respectively.

The position of degree classification as the primary measure of student achievement has increasingly been under scrutiny and the introduction of the Higher Education Achievement Record (HEAR) for graduating students from 2014 onwards is likely to dilute its prominence. However the extent to which the HEAR will substitute for or complement degree classification remains an unanswered question.

The current study investigates the impact of altering the algorithm upon which the BSc (Accounting) is awarded. The underlying rationale for the change was that students would perceive second year performance as of greater significance than previously and increased effort would lead to improved second year performance and, in turn, improved degree classifications. In addition, the structure of the accounting degree is such that performance in both second and final years influences professional accounting exemptions. Consequently improved performance in second year should also reduce the incidence of students graduating without gaining full exemptions. We empirically test whether the algorithm change does indeed have the predicted impact.

Background

Longitudinal data for the period 2002/03 to 2009/10 for degree classifications for Ulster and on a UK wide basis are shown on a percentage basis in Figure 1.

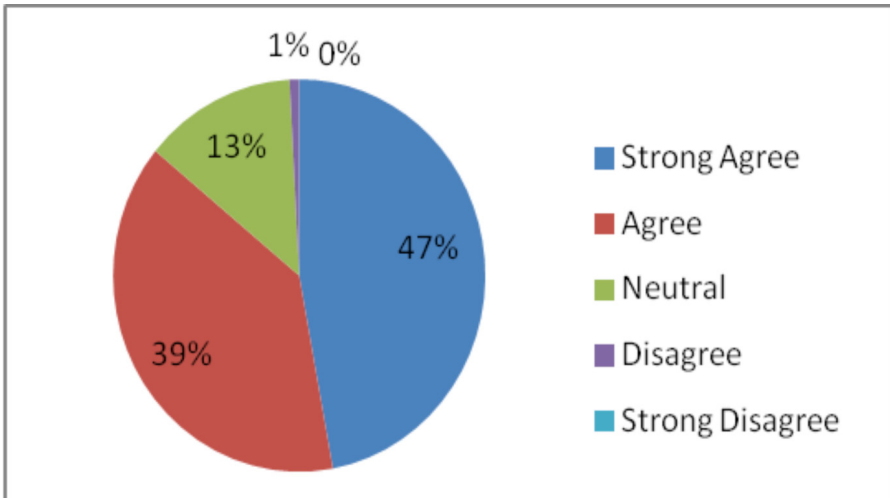


Figure 1 – Degree Classifications (by %) for period 2002-2010
(Data Source: HESA).

In percentage terms the relative incidence of First Class degrees has increased steadily from 2002 to 2010 though to a lesser extent at Ulster, particularly during the period 2007-2010. However in all years under consideration, Ulster has awarded a higher percentage of Upper Second Class degrees with the outcome that the proportions of “good” degrees (First Class and Upper Second Class) are broadly comparable to the UK average. A further divergence has also emerged during the period 2007-2010 with Ulster awarding a higher percentage of Lower Second Class degrees and a lower percentage of Third Class degrees with an average for the latter of 3.3% across the period compared to a UK wide figure of 7.3%. The overall results suggest a clustering of classifications in the Second Class category for Ulster in contrast to the higher incidences of both First and Third Class degrees observed in the UK data.

Clearly the aggregated UK degree data is likely to conceal significant variation across both institutions and disciplines and available evidence does indeed suggest this to be the case. Table 1 below confirms this to be case on a cross discipline basis with Veterinary Science awarding 33.3% of degrees with First Class Honours in contrast to Law where only 6.6% of degrees awarded are First Class Honours, both compared to an overall average of 14%.

	First Class	Upper Second	Lower Second	Third
Subject area	14.0	48.1	30.2	7.7
Medicine & dentistry	23.9	45.4	7.1	23.6
Subjects allied to medicine	15.6	45.3	30.5	8.6
Biological sciences	12.7	49.6	31.0	6.7
Veterinary science	33.3	57.1	9.5	0.0
Agriculture & related subjects	13.1	44.6	32.9	9.4
Physical sciences	20.3	44.7	27.4	7.6
Mathematical sciences	29.9	33.6	25.8	10.6
Computer science	18.4	35.8	32.2	13.6
Engineering & technology	21.6	41.0	27.9	9.4
Architecture, building & planning	12.8	46.7	31.4	9.1
Social studies	11.6	51.1	30.8	6.5
Law	6.6	51.7	35.0	6.6
Business & administrative studies	10.3	43.7	35.7	10.4
Mass communications & documentation	9.6	53.5	31.4	5.5
Languages	15.2	59.8	22.0	3.0
Historical & philosophical studies	14.3	61.4	21.2	3.0
Creative arts & design	14.6	49.7	28.9	6.8
Education	10.6	46.8	35.3	7.2

Table 1 – Degree Classification by % by discipline.

Source HESA 2008/09)

Within the Business and Administrative Studies category more detailed data is available from HESA for 2009/10 and again indicates considerable variation with roughly twice as many (in % terms) First Class degrees being awarded in Finance compared to Business Studies and Human Resource Management (see Figure 2 below).



Figure 2 – Degree Classifications (by %) for Degree Programs within Business and Administrative Studies Category for 2009/2012 (Data Source: HESA)

Degree classification by institution data is less accessible from HESA though previous work by Yorke (2002, p. 6; 2009) indicates significant variation by both institution and discipline. The latter study classifies institutions into three categories (Russell Group, Old Universities (excluding Russell Group), and New Universities) and investigates the percentage of “Good” Honours degrees awarded by each category of institution. He suggests that “Unexpectedly, the rise was much stronger in the elite “Russell Group” universities than in other institutions and, on the relatively limited evidence available from HESA regarding entry qualifications, there seemed to be no reason to conclude that entry qualifications constituted an important factor in the trend in honours degree classification.” More specifically the proportion of “Good” degrees awarded by Russell Group universities was 10% higher for Business and Management degrees and almost 13% higher for Accounting degrees than for Old Universities (the comparative figures for New Universities were 29% and 25% respectively). Evidently obtaining entry into a Russell Group university greatly enhances the likelihood of obtaining a “Good” Honours degree.

The final table of statistics relates to the degree classifications awarded within the Ulster Business School on four of the main degree programmes (Marketing, Human Resource Management, Accounting and Business Studies) for the past three academic years.

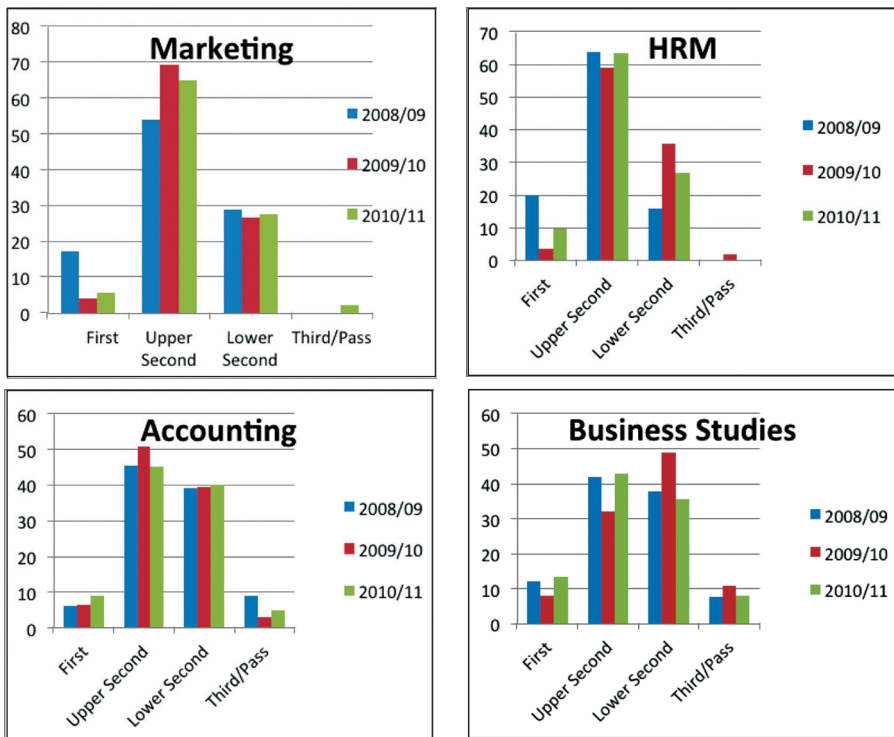


Figure 3 – Degree Classifications (by %) for Main Degree Programs within Ulster Business School for 2009/2012

In accordance with the previous statistics reported, a significant degree of variability is apparent across the four degree programmes. The Marketing and Human Resource Management degrees consistently award a greater percentage of “Good” degrees although the proportion of First Class degrees has declined significantly on both programmes. In contrast the Accounting and Business Studies programmes (which both include a significant number of part-time students) award comparatively fewer “Good” degrees.

Whilst there is likely to be a high degree of consistency within individual institutions in terms of the algorithms utilised to establish degree classifications, it is also evident that a wide variety of alternative algorithms are used across institutions. Some institutions, including Ulster, rely almost entirely upon performance in the final year of the degree programme on the “exit velocity” premise, whereas more commonly varying weightings are applied to performance in the penultimate and final years. Other significant variables across institutions include discounting the weakest mark(s), compensation/condonement of failed modules and rules regarding the “capping” of resit/retaken modules (Armstrong et al., 1998; Yorke et al., 2004, 2008). The impact of such institutional variation in determining degree classifications has been quantified by Woolf and Turner (1997) who suggested that as many as 15% of degree classifications might be different if they were processed through another institutions award algorithm.

Methodology and results

The current University of Ulster degree classification regulations are as follows:

“From 2009/10 intake onwards, the University has adopted the principle that the summary classifications of all awards represent the ‘exit velocity’ of the students and therefore should be determined by achievement at the highest credit level; (the full transcript evidences achievement in each module at the time it was taken). The only undergraduate exceptions allowed to this rule are in Honours degrees, if a professional body requires a level 5 contribution or the Faculty has made an acceptable case to the Teaching and Learning Committee”.

University of Ulster Assessment Handbook (2011, p.60)

In 2009, as a pilot study the University agreed (with student consent) to permit the second year (level 5) of the BSc degree in Accounting to contribute (25 percentage points) towards the final year classification. Accounting is a highly technical discipline, but embraces many higher level academic issues, such as the definition of income, ethics in accounting, the behavioural aspects of accounting control and the management of finance. The

degree embraces the ideals of academic rigour but recognises the importance of achieving professional accreditation. In this context, whilst many of the technical issues are addressed in the first two years of the programme, the final year is largely devoted to areas which have higher academic and reflective content. The degree does however rely upon the content of both level 5 and 6 modules for professional accreditation and therefore is ideally placed to explore the application of a different award algorithm.

An analysis was undertaken using available data from four cohorts of students (from 2007/2008 to 2010/11) where the second years' marks contributed to degree classification for the latter two cohorts (2009/10 and 2010/11) but not for the earlier two cohorts. Whilst performance in Level 5 is the primary variable under investigation, data was also obtained for tariff entry points, first year performance and absenteeism in second year as other possible explanatory variables. The data for the four cohorts is summarised in Table 2 below.

Total tariff points on entry

	2007/2008	2008/2009	2009/2010	2010/2011	Total
Mean	344	330	335	323	334
Median	340	330	320	320	330
Mode	340	300*	320	280	320
Std Dev	39.73	44.79	42.10	53.24	45.59
First Quartile	320	300	310	290	300
Third Quartile	370	350	360	360	360
Number	100	65	77	83	325

Kruskal Wallis test indicates significant differences between cohorts
(Chi-square 11.464, p=0.01)

First year degree mark

	2007/2008	2008/2009	2009/2010	2010/2011	Total
Mean	61.47	61.91	64.49	62.21	62.51
Median	61.00	62.50	64.00	63.00	63.00
Mode	61.00	60.00	58.00*	63.00	61.00*
Std Dev	9.48	9.51	8.90	10.35	9.60
First Quartile	55	56	58	53	56.00
Third Quartile	68	69	72	70	69.00
Number	95	70	83	85	328

Kruskal Wallis test indicates no significant differences between cohorts
(Chi-square 4.282, p=0.223)

Second year degree mark

	2007/2008	2008/2009	2009/2010	2010/2011	Total
Mean	54.28	57.78	62.74	60.22	58.48
Median	54.00	58.00	63.00	62.00	59.00
Mode	55.00	58.00	60.00	55.00*	55.00
Std Dev	10.73	10.71	9.15	12.81	11.36
First Quartile	48	50	55.75	53.00	51.75
Third Quartile	62	65	70.00	70.00	67.00
Number	106	77	82	85.00	350

Kruskal Wallis test indicates significant differences between cohorts
(Chi-square 31.045, p=0.000)

Second year absenteeism

	2007/2008	2008/2009	2009/2010	2010/2011	Total
Mean	20.84	17.11	18.23	26.62	20.87
Median	20.00	17.00	17.00	24.03	19.70
Mode	4.00	1.00	1.00	2.00	1.00
Std Dev	13.70	11.97	12.85	16.63	14.39
First Quartile	8.00	6.50	8.25	12.89	9.00
Third Quartile	31.00	26.75	25.00	39.30	30.04
Number	111	80	100	99	390

Kruskal Wallis test indicates significant differences between cohorts
(Chi-square 19.873, p=0.000)

*Multiple modes exist, the lowest is reported

Table 2 – Descriptive statistics

From Table 2 statistically significant differences emerge between entry tariff points, absenteeism and second year degree performance for the four cohorts. The entry tariff points exhibit a decreasing median in contrast to second year performance where the median mark is increasing. To further investigate this finding a dummy variable (SC) is created which takes the value 1 if the second year degree performance contributes towards final classification for the cohort, and 0 if it does not. Both parametric and non-parametric tests are employed to investigate whether a second year contribution does indeed result in higher average marks. The results are reported in Table 3.

	SC	N	Mean	Std. Deviation	Std. Error Mean
AV2	0	183	55.75	10.829	0.800
	1	167	61.46	11.199	0.867

t-test on equality of means -4.845* (0.000)**

Mann-Whitney Z -5.053 (0.000)**

+ Levene’s test on the equality of variance indicates that the variance of the two groups is equal, therefore t-tests on the equality of the means for the two groups is based upon the equality of variance.

* Significant at the 5% level using a two-tailed t-test. ** Significant at the 1% level using a two-tailed t-test.

Table 3 Group Statistics for Level 5 performance (AV2) with (1) and without (0) Level Five Contribution.

Table 3 reveals that the average second year mark for those cohorts for which a 25% contribution applied is higher by almost 6%, the difference is statistically significant and represents an increase in degree classification, albeit at level 5. Whilst convincing, this result alone does not provide definitive proof that it is the second year contribution which is driving the observed improved performance. For example, the analysis thus far has also demonstrated that there are statistically significant differences between cohorts in relation to tariff points on entry and absenteeism. In order to further investigate the impact of these divergences a multivariate model is constructed to explain second year performance. More specifically the following model is investigated using ordinary least squares regression:

$$Y = \beta_0 + \beta_1 TT + \beta_2 AV1 + \beta_3 ABS + \beta_4 SC + \mu$$

Where,

Y is the average marked achieved in year 2 (AV2),

β_0 is a constant term introduced as a rather *ad hoc* way of capturing the impact of omitted variables,

TT is the total tariff points on degree entry,

AV1 is the average mark achieved in year 1 modules,

ABS is the percentage absent from all time tabled classes in year 2,

SC is a dummy variable which takes the value 1 if the second year contributes towards the final year classification and 0, if it does not, and

μ is a stochastic error term.

In essence this model attempts to control for the potential impact of other factors upon the relationship between Level 5 performance and the classification framework employed. The results from the estimation of this model are presented in table 4.

$$Y = \beta_0 + \beta_1 TT + \beta_2 AV1 + \beta_3 ABS + \beta_4 SC + \mu$$

β_0	β_1	β_2	β_3	β_4	R_A^2
18.687	0.015	0.590	-0.251	3.755	0.600
(0.000)**	(0.112)	(0.000)**	(0.000)**	(0.000)**	

Number of observations is 271.

* Significant at the 5% level using a two-tailed t-test. ** Significant at the 1% level using a two-tailed t-test.

Note: Stepwise estimation reveals that the independent variables entered on step in order of explanatory power are, AV1, ABS and SC.

The regression analysis excludes overseas (DUFE) students as such students have no entry tariff points. It should also be noted, that students with extenuating circumstances are excluded in both of the average mark achieved in both years 1 and 2.

Table 4: OLS Regression analysis

From table 4 the only independent variable which is not statistically significant is total tariff points on entry. Having controlled for first year performance, total tariff points on entry and absenteeism, the introduction of a second year contribution is significant in explaining second year performance and, on average, adds approximately 4% to the marks achieved. The negative coefficient on the absenteeism variable highlights the negative impact upon student performance.

The constant term is significant indicating the existence of omitted variables but, notwithstanding this, the explanatory power of the model is high at 60% (as measured by adjusted R-squared). Other independent variables including gender, mature degree entry, and degree entry with double award tariff points were also investigated, but none of these were found to be statistically significant in explaining the average second year mark.

The vast majority of second year students in the 2009/2010 cohort graduated in 2011 (except those proceeding to take a placement year and those with extenuating circumstances). As the final part of the analysis is at an aggregate level, the average final year marks (which included the 25% second year contribution) are compared with the average final year marks (FA) of other students (with no second year contribution) within the four cohorts under study who had also graduated at the first attempt. Table 5 provides the descriptive statistics for final year classification marks and the results from subsequent analysis are further presented in table 6.

	2009	2010	2011	Total
	%	%	%	%
Mean	56.45	57.42	60.89	58.39
Median	55.00	57.00	62.00	60.00
Mode	51.00*	57.00*	60.00	60.00
Std Dev	7.17	10.390	10.37	9.692
First Quartile	52.00	52.25	56.00	54.00
Third Quartile	63.00	63.00	67.00	64.00
Number	51	60	63	174

Kruskal Wallis test indicates significant difference between cohorts (Chi-square 15.530, p=0.000)

*Multiple modes exist, the lowest is reported.

[Table 5 Descriptive statistics for students graduating at the first attempt](#)

Table 5 clearly indicates that there is an improvement in average award performance when the second year performance is a contributory factor. Furthermore, there is a statistically significant difference in final year marks, contributing towards classification categories across all three graduating cohorts.

Group Statistics

	SC	N	Mean	Std. Deviation	Std. Error Mean
FA	0	111	56.97	9.027	0.857
	1	63	60.89	10.372	1.307

t-test on equality of means -2.604⁺ (0.010)**

Mann-Whitney Z -3.803 (0.000)**

+ Levene’s test on the equality of variance indicates that the variance of the two groups is equal, therefore t-tests on the equality of the means for the two groups is based upon the equality of variance.

* Significant at the 5% level using a two-tailed t-test. ** Significant at the 1% level using a two-tailed t-test.

Table 6 Group Statistics of Degree Classification award marks in final year (FA) with (1) and without (0) Level 5 contribution.

Table 6 reveals that the final year mark is higher for those students whose second year mark contributes to the classification. The difference is statistically significant and, on average, represents an increase in actual degree classification. Of course the actual classification award achieved is at an individual level, and dependent upon an individual student’s mark profile, whereas all of the above analysis has been conducted at an aggregate level.

An analysis of the marks confirmed at the June 2011 examination board reveals that, at an individual student level, the application of a second year contribution resulted in a positive increase in classification for four students which equates to six percentage points of the graduating cohort in 2011.

Conclusions and recommendations

The current UK degree classification system, despite its apparent longevity, has increasingly become criticised on the basis that resulting classifications do not provide a sufficient degree of granularity in differentiating student performance. Other systems exist, such as the Grade Point Average (GPA) operated in the USA, which appear to provide a more precise measure of performance

(students received a final mark between 0 and 4 expressed to two decimal places) but which also has faced accusations of inconsistent methods of application across institutions (Soh, 2011). Despite such criticism a move to GPA is currently under consideration by a small number of predominantly Russell Group institutions (Times Higher, June 2011).

The Burgess Group, which issued a final report in 2007, did not suggest an alternative to the Honours classification system but concluded that the summative judgment which the current system entails is the problem. More specifically a single overall judgment about performance is at odds with lifelong learning and detracts from information which conveys a fuller understanding of the complex nexus of knowledge and skills acquired by the graduate. The report proposed that the current summative judgement should be replaced with a wider more detailed range of information which more fully encapsulates a student's strengths and weaknesses. As a result all students entering university in 2011 will be issued with a Higher Education Achievement Report (HEAR) upon graduating.

However, despite this ongoing development, it is likely that the HEAR will continue to contain an overall summative assessment, most probably the current Honours classification measure, at least in the short to medium term. In addition, comparability across institutions is likely to prove problematic if the summative judgments forthcoming prove informal or ad hoc. Furthermore an employer's requirement for simplicity could conflict with the desire to provide as much pertinent information as is feasible. Against this backdrop the Honours classification is likely to retain prominence for some time to come. Consequently it is incumbent for institutions to avoid placing their graduates at a disadvantage in the employment market by continuing to utilise an algorithm which results in lower degree classifications than comparable institutions.

The results of the study were considered by the University Teaching & Learning Committee in December 2011. Following consultations with the PVC Teaching & Learning it was concluded that although the results appear convincing they are not conclusive and, to permit further analysis, the pilot would be extended for a further two years to allow additional data to be collected.

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Gillian Armstrong (Dept of Accounting): Head of Department
Peter Green (Dept of Accounting): Senior Lecturer in Accounting and Finance and Course Director for QA Business School
Gregory McGrath (Dept of Accounting): Lecturer Accounting and Finance and Course Director BSc(Accounting)
Michael Pogue (Dept of Accounting): Lecturer in Accounting and Finance

University Challenge: bridging the gap between secondary and tertiary education

Anthony Cook, Faculty of Life and Health Sciences,
University of Ulster

Introduction

Nearly eight percent of students who entered UK universities in September 2008 were no longer in the higher education system at the start of the following academic year (HESA, 2012). Most of these students withdrew voluntarily. This deceptively low figure conceals the fact that 28,210 individuals decided that the university system in the UK was something that they did not want to be involved in. This rate of student loss is better than that in most jurisdictions since international comparisons show that the UK has the fifth highest graduation rate among developed countries (NAO, 2007). Why do students work hard to gain a competitive place at a UK university and then withdraw?

The issue of student withdrawal has been well researched and there are many models which describe the processes involved (Cook and Rushton, 2008). The most widely referenced is that of Tinto (1987) who worked with students in the USA. He described a process which starts before entry building on factors such as goals, expectations, skills base and institutional commitment, and related these pre-entry attributes to the social and academic factors students met on campus.

These pre-entry factors are worthy of a little elaboration since they can determine how a student responds to their experiences in the first few weeks in higher education. A student's goals often depend on their career aspirations and a consequent motivation to succeed that is external to the course or institution. Student expectations relate to those experiences at school and at home which have determined the student's view of what higher education is going to be like, both academically and socially. All degree programmes assume that a student arrives with a set of skills and a knowledge base that can be taken for granted when designing the first year curriculum and formulating the teaching and assessment

methods. If these staff expectations prove to be ill-founded then this may influence student persistence. Finally many students have or develop a commitment to attend an institution. This can be related to its locality, a perception of its strengths or a family history of attendance. Acting together these factors form a student's view of what being at a particular institution will be like.

Tinto proposed that the interaction between this basket of pre-entry factors and the initial experiences of a student when at the institution results in varied commitment levels which culminate in some students deciding to leave, others under-performing and yet others exceeding expectations of their academic performance. Tinto's was the first analysis of retention that did not entirely blame the student, but rather focused on an incompatibility between the institution and the student. Much of this incompatibility relates to the expectations students have of how they will be taught, how they will relate to the staff who teach them and the extent to which they will be supported both by staff and by a social network (Cook, 2009). It also relates to academic staff who harbour inaccurate or unrealistic expectations of what new students know and can do. There is a 'golden halo' effect in which academic staff still believe that new students enter university with the same gifts and attributes as did they and their immediate peers (Pargetter *et al.*, 1998).

Statistical analyses of the factors associated with student withdrawal in UK universities have been reported by Yorke (1999). Although he concluded that non-completion was a multi-factorial problem, he also highlighted the major issues cited by students who had withdrawn. These included choosing the wrong field of study, lacking commitment to the programme, unexpected aspects of the programme and teaching which did not suit them. Despite a decade of well funded interventions the problem was much the same when Yorke completed a similar survey nine years later (Yorke and Longden, 2008). The factors associated with early leaving contribute to a picture of inadequate preparation, faulty information and false expectations leading to a poor early experience at university. This paper will focus on "incongruence", a systemic failure of two phases of education to provide a seamless junction through which students can pass.

Incongruence

Incongruence (or incompatibility or dissonance) is a term coined by Cuseo (2002) to signify the lack of alignment between what students' previous experiences prepares them for and what they actually experience in higher education institutions. There is a step change between what many students experience at school or college and what they experience at university. While this may be stimulating for some, for many it is more than they are prepared to cope with and leads to demotivation and early leaving (Cook and Rushton, 2008). The notion of student transition has been introduced to describe the ways in which this gap may be bridged for those who might not cross unaided. Students have to change in a variety of aspects including their study habits, their financial arrangements such as part time employment, living away from home and their social lives (Cook, *et al* 2005).

By comparing a GCE (General Certificate of Education) A-level specification with a typical set of first year university modules, Cook (2005) observed that the GCE syllabus provided a perimeter within which an examiner could set assessments. The examining board provided such extensive clarification of the syllabus and exemplar coursework that students could attain high marks merely by learning the materials provided by the board. The description of university courses and modules, on the other hand, was wider and specified only the minimum expectation of a student who passed. Students would need to deploy considerable research skills in order to find the information required to do well in the university specification since the university intends to promote independent learning and move away from teacher led study. Assessment techniques also serve different functions (Boud and Falchikov, 2006). Further contrasts between university and school are outlined in Table 1. This illustrates how the systems to which new students have become adapted prior to entry differ in aspects of curriculum description, the role of the teacher, the details of assessment and the social environment.

With the publication of school examination results, an oversupply of school places and a restricted number of university places, competition between schools is inevitable. Competition forces improvements in what is being measured and reported. This would be advantageous to higher education if what was being measured

Pre-tertiary	Tertiary
Assessable curriculum totally specified	Assessable curriculum a specified minimum
Teaching function separate from the assessing function	Teachers are also the assessors
The primary focus of teaching staff is to teach	Academic staff have multiple functions and expectations
Objective questions and detailed mark schemes to facilitate multiple markers	Greater use of academic judgement in marking
Single word. Short answers common	Expectation of extended writing
Reliance on examinations- assessing the products of learning	Greater use of coursework- assessing the process of learning
Group work rare or non-contributory	Group work encouraged and frequently assessed
Frequent non-contributory formative assessment	Formative assessment frequently contributing to summative outcomes.
Coursework refined in collaboration with teaching staff	Coursework assessed on first submission
Summative assessment can be repeated to increase grade	Summative assessment only repeated to “expunge failure”.
No fees	Debts incurred paying tuition and maintenance fees
Living at home	Living independently or at least mixing with those living independently

Elements of this list have been adapted from Pargetter *et al* (1998)

Table 1: Differences between tertiary and pre-tertiary systems.

was the suitability of students for a university experience. Secondary qualifications do much more than this however, since they are used as measures of school performance, are subject to competition between boards, are influenced by government policies and targets and are career qualifications in their own right. Before the introduction of the national curriculum in 1989 secondary and tertiary teachers could find common cause in many aspects of their work. Since that time however developments at secondary level have been driven by the targets in the national curriculum and the statutory instruments which accompany them. Tertiary education on the other hand has been driven by expansion and a business oriented model (Knights, 2004). This is reflected by government administrative arrangements which have seen secondary education remaining the responsibility of a Department of Education while tertiary education has been subsumed into a department of business.

Universities also compete with each other for students but, because student performance is not the only consideration either for funders or for applicants, the competition is more subtle. Students make choices of university based on a variety of factors including subject availability, proximity to home, the perception of the quality of the social life, university facilities and university public reputation (Price *et al.*, 2003). The academic performance of past students is not a significant factor but graduate employability appears to be an increasing factor in determining the choice of course, if not the choice of institution (Ward and Watts, 2009).

The UK is not the only country facing problems in the congruence between a secondary and tertiary education system. David Conley in the USA context has written:

“Almost all of the rules of the game that students have so carefully learned and mastered over the preceding 13 years of schooling are either discarded or modified drastically. The pupil-teacher relationship changes dramatically as do expectations for engagement, independent work, motivation, and intellectual development. All of this occurs at a time when many young people are experiencing significant independence from family and from the role of the child for the first time.”

(Conley, 2007)

Incongruence can be tackled by changes in the secondary curriculum and the ways in which it is delivered and supported. Influence has been exerted over the US high school curriculum either directly through a KSUS (Knowledge and Skills for University Success) inventory (Conley, 2005) or indirectly through admission tests for students (e.g. ACT formerly the American College Test). These two approaches, the former applied to curricula and the latter to aspiring students, incorporate the idea of college readiness, which is broader than subject mastery (Conley, 2005). Thus the measurement and use of students' college readiness can influence student preparation prior to entry either through the initiative of individuals or the development of school curricula.

Processes which are possible in one jurisdiction are not necessarily going to be practical in another. In this instance there is no statutory national testing system in the high schools of the USA and this frees them to adapt their curricula within state guidelines to meet their own institutional missions. Universities, either individually or collectively, can therefore influence the ways in which students are prepared for a higher education experience. A national examining system under centralised control such as that in the UK appears to be less likely to respond to the opinions of the higher education sector (Smith *et al.*, 2006; Conley, 2003).

Although the extent to which the traditional GCE A-level prepares students for higher education in the UK is questionable, the public support for and trust in this system remains high since it is based on perceptions of student effort and school reputation (Ipsos Mori, 2009). In the short term moves to align the secondary and tertiary student experience in the UK, will rest with adaptations implemented during the university first year experience.

Pre-entry practices

Pre-entry practices by universities are widespread and well disseminated (Cook and Rushton, 2009). They will always, however, be on a small scale and directed towards widening participation since the bulk of students (and therefore the bulk of funding) still enters immediately on leaving secondary education and with the traditional A level qualifications. Some small scale attempts have

been made in the UK to identify attributes which pre-dispose new students to success. Goldfinch and Hughes (2007) have related student learning styles and initial confidence in their study skills to subsequent progression. They found that activist learning styles were associated with low progression and that over-confident students were not as successful as those more aware of their need for improvement. Self-reliance was also associated with success. Identifying attributes associated with success and failure is a pre-requisite for meaningful targeted intervention.

Student induction

Student induction can be seen as an attempt to bring a student's prior experiences rapidly into line with those to be expected in the first year at university. It has been the focus of much work and innovation (Edward, 2003; Frame, 2001; Cook *et al.*, 2006a &b). Induction does however need to be extended throughout much of the first year (Maguire 2006). Students remember little of the first few days of their university experience and effective transition is not accomplished quickly (Thomas *et al.*, 2005). Teaching and assessment styles which align with those commonly experienced in school have been shown to be a key factor in promoting student retention at University (Torenbeek *et al.* 2009). Such styles however can merely prolong and reinforce prior experiences and can postpone a difficult transition to later periods of the university career. An extended induction and a smooth transition to university style learning which fosters independence, self awareness and experimentation is essential for success within higher education.

Conclusion

The student retention problem in many UK universities is one of balancing widening participation initiatives with effective teaching systems to ensure the attainment of higher education goals. The solution is therefore to prepare students for the university experience and to adapt the first year experience to further improve retention. The challenge for the UK post 16 examining system is whether it can measure college readiness adequately while providing both qualifications which have value in their own right and data on school performance which have public credibility. The challenge for secondary and tertiary educational systems is how to pass students

from one to the other as seamlessly as possible while preserving graduate standards.

Summary

The retention of students is a complex multi-factorial problem. Part of that problem is the misalignment of secondary and tertiary education systems which has developed over recent years in response to different pressures from different arms of government. Alignment can be improved by university outreach activities which better inform potential students about what to expect of higher education. Once in university, further alignment can be promoted by an extended student induction process which promotes, rather than assumes, independence and self reliance.

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Tony Cook is an Emeritus Professor of Teaching and Learning at the University of Ulster and a National Teaching Fellow. He initially specialised in Animal Behaviour but during the last 20 years has become increasingly involved in educational development, particularly in the first year experience.

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