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Contents

Foreword

I am delighted to provide a short Foreword for the first issue of the Centre for Higher Education Practice's journal, *Perspectives on Pedagogy and Practice*. The purpose of the publication is to share practice in teaching and learning across the University, through articles and case studies provided by internal and external contributors. It will also afford colleagues who may be relatively new to pedagogical research an opportunity to present their work to the wider university community both at Ulster and further afield. By providing a valuable forum for scholarly reporting and discussion of developments in all aspects of teaching and learning it should raise the profile and enhance the status of teaching and learning at Ulster.

The contents of the first issue include articles and case studies embracing a range of topics and exploring issues in pedagogy and practice that are being progressed in a variety of higher education contexts.

I would encourage all colleagues to engage with this emergent community of reflective, innovative and evaluative academic and teaching and learning support practitioners. As well as bringing its own professional and scholarly rewards to contributors, the adoption, adaption and implemenation of the effective practice disseminated in the Journal can only enhance further the learning and teaching experience of our students.

Professor Denise McAlister
PVC (Teaching and Learning)

Editorial: Volume 1, September 2010

Welcome to the first issue of Ulster's new journal – *Perspectives on Pedagogy and Practice*. The establishment of the Journal underlines the University's strong commitment to teaching and learning and the value it places on the scholarship of practice. It is anticipated that the Journal will provide an important outlet for those members of staff who engage in new initiatives in teaching and learning and those who are seeking to enhance existing approaches. For many staff, it is anticipated that writing for the Journal will be a 'stepping stone' to external publication.

The first issue has a range of contributions and includes articles from external and internal contributors. The external articles represent invited contributions and are written by academics closely associated with the Centre for Higher Education Practice. They are familiar with the challenges faced by those attempting to promote the enhancement of teaching and learning activities, whilst also encouraging staff to engage in research to inform practice.

The first article, by Ranald Macdonald (who has been closely associated with the work of the Centre), explores the links between research and teaching and ways of bringing these both together. It is acknowledged that there is already much excellent practice going on in teaching and learning within Ulster. However, the challenge presented for Ulster is how to share the principles that make practice successful to create a culture of collaborative inquiry as the basis of learning for staff, students and the University itself.

The articles which follow cover a range of initiatives across the University. These include new approaches to teaching and engaging students more actively in the learning process; research investigating the factors which influence student attainment in first year; an initiative which seeks to ease the transition process for students entering university and the provision of support to students in a difficult subject area.

Tara Moore was awarded a National Teaching Fellowship in 2005, by the Higher Education Academy (HEA), for her role in online

education in biosciences at the University of Ulster. With the funding awarded by the HEA, the online delivery has progressed from one module to a fully online PgD/MSc course in cataract and refractive (laser eye) surgery. The article highlights some of the key issues in engaging adult learners and the value of the discussion forum, allowing the immediate processing of newly acquired information and its application into everyday practice.

Sharon Conway, Cathal Breen and Karen Fleming's case study focuses on the introduction of an innovative way of teaching anatomy. Traditional teaching of anatomy uses hard plastic models, dry bones and, in some cases, cadaver dissection. The authors question whether these options are the most effective teaching methods when the primary learning outcome for health professionals is the ability to apply anatomy knowledge to living human beings. The case study then describes a tactile method of teaching anatomy, in the form of body painting. Student and staff reactions to the initiative are described, and advice given for those considering the introduction of a similar approach.

Stephen McClean and Paul Hagan's paper describes the introduction of student-generated videos of practical classes in chemistry. First year students are formed into groups and each group must reflect on aspects of the practical when making the video, highlighting anything difficult and offering advice to someone repeating the experiment at a later time. Videos are uploaded and shared with all other students on the module. The authors suggest that this initiative has provided a collaborative and inclusive peer-learning environment for biosciences students, in a subject that is often perceived as difficult.

James Davis, Laura Newton, Ray Leslie and Peter Slater suggest that the use of origami can provide an engaging activity through which information can be conveyed and key concepts reinforced. A modular cube design was adopted as the core system where information could be placed on each face, effectively generating a Rubik's cube type puzzle. The authors suggest that the project creates a versatile vehicle for stimulating user involvement and discussion, which is essential for improving the dissemination

and retention of core facts. Templates, using PowerPoint, and instructions for assembly of the cube are available from the authors, together with video clips detailing the folding of the cube.

The study conducted by Peter Green, Michael Pogue, Gregory McGrath and Abbey Wilson attempts to identify student characteristics associated with poor performance in first year modules in two undergraduate degrees. The results obtained provide empirical support for the link between attendance and subsequent performance. Evidence is also presented for other pertinent variables, including limited private study, living at home and entry with double tariff awards. No easy solutions for retention and performance are identified. Indeed, the authors suggest that further research is needed, including tracking students through the degree programmes to investigate the link between first year attainment and future performance on the programme.

Greg Kelly and Mark Poulter suggest that students can experience a ‘culture shock’ when they first arrive at university and their lives can become temporarily unbalanced. The paper describes the development of an online interactive tool – the Wheel of Life and Health – to help students chart their current perceived competence in different dimensions of university life. The Wheel enables students to visualise the competences in an easy-to-follow display and, through reflection, may help them to restore some balance. Further developments to the tool are ongoing and the authors anticipate that the Wheel could provide a focal point for Personal Development Planning.

Joan Condell and Pratheepan Yogarajah describe the introduction of Peer Assisted Learning (a type of Supplemental Instruction) to support second year students learning mathematics. This module presents many challenges in terms of delivery, teaching and assessment and the paper argues that Peer Assisted Learning in Mathematics (PALM) has provided a valuable approach to improve student pass rates in a difficult subject area. It is suggested that this approach could be readily extended to other analytical subjects across the University.

The final paper by David Boud, Visiting Professor in Teaching and Learning to the University, addresses the issue of assessment and suggests that changes in assessment activities have lagged behind those in teaching and learning. This may indeed be true, as an analysis of all the articles submitted to the Journal to date indicates that none have related to assessment practices. The paper questions whether assessment is being done as effectively as it could and asks how assessment can better contribute to student learning. Published under a Creative Commons licence, the paper provides a simple statement of key features of assessment with brief justifications to prompt discussion about what changes should be made and why they should be made.

I hope you enjoy reading this interesting and varied collection of papers in the first issue of Perspectives on Pedagogy and Practice and I would like to express my sincere thanks to all members of the Editorial Sub-Committee for their efforts in bringing the journal to fruition.

We would welcome your views on the journal and how it might be enhanced in the future, so please feel free to communicate these to any member of the Sub-Committee.

Professor Kate Greenan
Chair of the Editorial Sub-Committee

Academic practices: how research and teaching come together as learning for both academics and students

Ranald Macdonald

Introduction

> "The relationship between teaching and research is among the most intellectually tangled, managerially complex and politically contentious issues in mass higher education systems" (Scott, 2005).

If asked to give a personal definition of my 'research', I would probably include some of the following characteristics: looking at the world critically; being inquisitive and asking questions; finding out what is already known; experimentation and seeking out data/ information; analysing and making sense of the data; acting on conclusions or generating further questions; and communicating with peers to reflect on how specific or general my approach, processes and outcomes are. My research is about Higher Education in general and learning, teaching and assessment more specifically.

However, what has always been important to me is the impact of that research on my teaching, my practice as an academic developer and changes in institutional policy relating to learning and teaching. A good example of this has been my work on plagiarism (Macdonald and Carroll, 2006), which summarised some of my work as it affected all three areas. Working with fellow academics across the University, there was often a tension between their roles as researchers and teachers and how their research could inform both the content of their teaching and the ways in which they taught, as well as their students' experiences of research in the curriculum. National policy and funding did help in a particular way from 2006.

As part of its revised Teaching Quality Enhancement Fund (TQEF) arrangements for 2006-07 to 2008-09, the Higher Education Funding Council for England (HEFCE) introduced, as one of its national strategic priorities for learning and teaching in HE, the notion that teaching should be "informed and enriched by research" (HEFCE, 2006/11). Funds were allocated in inverse proportion to

research funding. The rationale for the initiative was summarised as:

> "A learning environment informed by research provides learners with an understanding of knowledge creation (the research process and research methods) and its application (in economic, social, health and global contexts). It also stimulates key skills of critical analysis, respect for evidence and informed decision-making. We feel that a research-informed environment to stimulate the development of knowledge and skills is appropriate to all levels of student learning in higher education." (para. 21)

And that is the challenge we face: to bring together our practices as researchers and teachers to provide a more holistic and fruitful learning environment and experience for all in Higher Education. To return to my characterisation of my research and its relationship to my practice as first a teacher and latterly an academic developer, the key notion for me has been how I, my students and my colleagues and clients, engage in collaborative inquiry as the basis for our learning.

What do academics do?

In seeking to be a well-rounded and comprehensive 'university', as well as striving to achieve the four generally accepted areas used to describe such an institution – research, teaching, community engagement and knowledge transfer – we should also look to promote synergies between these areas at institutional, departmental, course and individual levels. At the individual level this relates to the notion of academic practice – research, teaching, scholarship, academic management and leadership, and service (internal and external to the university).

However, at any moment in time, individual staff may well be engaged in the various aspects of academic practice in differing proportions to either their colleagues, or to other points in their careers. Ernest Boyer in his seminal work on scholarship (1990) is attracted to Lee Knefelkamp's notion of seasons in academic life and uses it as a metaphor for the different periods faculty go

through in seeking tenure, becoming a professor and moving into late career.

A major challenge for a university is for all staff to engage either in or with research and for the research of those engaged solely or largely in this activity to find its way back into the curriculum. Our aim should be to develop a learning environment in which students experience a close synergy between research and teaching and where the focus on enquiry, critical thinking and working collaboratively to promote better understanding and problem solving, is central to our educational endeavour.

How is research seen?

In its consultation on the forthcoming Research Excellence Framework, the Higher Education Funding Council for England (HEFCE, 2009) defines research as:

> " … a process of investigation leading to new insights effectively shared." (Glossary of terms, p.50)

Stenhouse (1981) begins with a somewhat wider definition of research:

> " … is systematic and sustained inquiry, planned and self-critical, which is subjected to public criticism and to empirical tests where these are appropriate. Where empirical tests are not appropriate, critical discourse will appeal to judgement of evidence – the text, the document, the observation, the record. In applied or action research the test or evidence may be provided by substantive action, that is, action which must be justified in other than research terms." (p.113)

Reflecting on the nature of research in a supercomplex world, Barnett (2000) contends that the university is a "site of organised inquiry for generating and managing uncertainty", where generating the uncertainty is the role of research, and enabling individuals to live with uncertainty is the university's teaching or educational function (p.143). However, he sees the two functions – research

and teaching – as continually straying into the other. Research has become reactionary, "shoring up the existing pillars of knowledge" and as a force for stability. Barnett goes on to classify research (Table 1) with academics largely operating at (i), occasionally at (ii) or (iii) but rarely at (iv), that is, "assisting in the reframing of forms of understanding in the public consciousness". He calls for the Research Assessment Exercise (RAE) to embrace wider criteria of research, whilst acknowledging the need to contribute to the assessment exercise.

	Projection with academe	Projection beyond academe
Endorsing	(i) Paradigm-endorsing	(ii) Commentating
Creative	(iii) Revolutionary	(iv) Reframing

Table 1. Classifications of research.

Scott (2005) sees in intellectual and practical terms a growing overlap between research and teaching, whilst in policy and political terms the opposite is true with a growing separation between the two. Quoting Humboldt (1810) on the future of the University of Berlin, Elton (2005) notes that in both teaching and research, "universities should treat learning always as consisting of not yet wholly solved problems and hence always in a research mode", the implication being that the curriculum should focus on inquiry and engaging with problems in much the same way research does.

What are the implications for a university? (Like ours ...)
A challenge for the University is to see research and teaching leading to the same outcome – learning – and being able to frame both agendas as dealing with uncertainty, ambiguity, risk taking and inquiry, rather than the certainties addressed in much of the traditional, knowledge-based curriculum. Even in professionally oriented courses such as nursing, accountancy or architecture, graduates will be operating in uncertain and changing conditions where it is *how*, as much as *what*, they have learned that will enable them to respond professionally.

All staff should belong to a research group of some sort, not necessarily as active researchers, but to engage *with* discipline-focused research and scholarship in a learning community which also considers the implications for student learning and the curriculum. Many would consider it equally important for academics to research the effectiveness of their teaching on student learning as well as the content.

There should be recognition, as HEFCE provides, of pedagogic research as a legitimate and integral part of the university's research mission to enhance the quality of learning and teaching. The growth of EdDs and professional doctorates should be encouraged. The relationship between research and teaching is also more fundamentally about the role and future of a university in the 'knowledge society' (Scott, 2005) and so a broader research agenda contributing to a better understanding of effective teaching will enhance the quality of the university's provision in many respects. Links between research and teaching differ significantly between disciplines and so over time 'one size does not fit all' when defining research. Exploring these differences and their relationship to learning and teaching in the disciplines would be a worthwhile activity. Research needs to be defined in more open and imaginative terms within the broader canvas or framework of academic work, rather than a "quasi industrial process of systematic inquiry" (Scott, 2005).

What does it mean for the student learning experience?
Drawing on a paper by Griffiths (2004), Healey (2005) links curriculum design to the relationship between research and teaching (often called a 'nexus' in the literature) (Figure 1).

Whilst much teaching in many universities is in the bottom left quadrant of Figure 1, we should be looking to move to the top right, where the curriculum engages students as active participants in dealing with research processes and problems, perhaps best typified by inquiry-based learning. Here the emphasis is less on linking research and teaching and more on changing the nature of learning and hence the focus will be on the need to change the curriculum, particularly in respect of how students will be learning through inquiry.

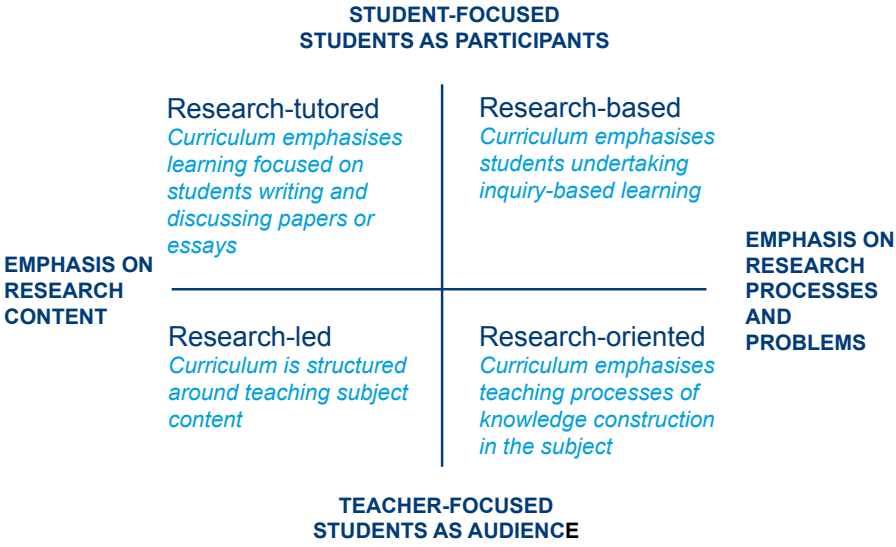

Figure 1. Curriculum design and the research-teaching nexus.

Trowler and Wareham (2007) provide a useful summary of the dimensions of the so-called "teaching-research nexus" with examples of practices, benefits and problems. Dimensions include:

- Learners do research;
- Teachers do research;
- Teachers and learners research together;
- Research is embedded in the curriculum;
- Research influences the *what* and the *how* of curriculum design;
- Research culture influences teaching and learning;
- Teaching and learning influences research; and,
- Relationship between research, teaching, the university and its environment e.g. knowledge transfer/'third stream' activities.

At Sheffield Hallam University, we adopted an approach to enhancing the links between research, learning and teaching which addressed four themes as set out in the Learning, Teaching and Assessment Strategy for 2006-10 (Sheffield Hallam University, 2006) namely:

> "Research will impact on student learning in a number of ways: the integration of discipline research into the

> curriculum; learning and teaching research to inform practice; students doing their own research and engaging with the research of others; policy and strategy research and evaluation". (Theme 3, p.6)

A consequence of this was the appointment of seconded Teaching Fellows in each Faculty to lead developments appropriate to their own context, including changes to the curriculum, establishing student-led research journals and a recognition of existing excellent practice in many areas. It also led to the Centre for Promoting Learner Autonomy, one of the University's Centres for Excellence in Teaching and Learning (CETLs), refocusing much of its activity on inquiry-based learning, as also seen at the Centre for Excellence in Enquiry-Based learning (CEEBL – http://www.campus.manchester.ac.uk/ceebl/) at the University of Manchester.

At the University of Ulster, the Centre for Higher Education Practice introduced themes very similar to those at Sheffield Hallam: research-led and research-informed teaching, pedagogic research and research-based learning. There is already much excellent practice going on and now the challenge is to share the principles that make it successful to create a culture of collaborative inquiry as the basis of learning for staff, students and the University itself.

And finally . . .

A useful set of case studies, *Developing undergraduate research and inquiry*, has been collected by Healey and Jenkins (2009), with a comprehensive set of references. Other resources are available from the Higher Education Academy's Subject Networks – www.heacademy.ac.uk/subjectcentres – and EvidenceNet – http://www.heacademy.ac.uk/evidencenet as well as the various CETLs involved in the Learning Through Enquiry Alliance (http://www.ltea.ac.uk/) which also explore the relationship between research and teaching in learning.

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Ranald Macdonald is Emeritus Professor of Academic Development at Sheffield Hallam University – where he was employed until July 2009 – and a Higher Education Consultant. A previous Co-chair of the Staff and Educational Development Association and founding Chair of its Scholarship, Research and Evaluation Committee, he is also a SEDA Fellowship holder and was awarded a National Teaching Fellowship in 2005. Ranald is a Senior Associate: Professional Development with the Higher Education Academy's Centre for Sociology, Anthropology and Politics.

National Teaching Fellowship project – from short course to fully online MSc in Cataract and Refractive Surgery (Theory)

Tara Moore

Introduction

I was awarded a National Teaching Fellowship (NTF) in 2005 by the Higher Education Academy (HEA) for my role in online education in the area of biomedical sciences within the University of Ulster. At that time, all NTF applications included a proposed project which would be carried out if the application were successful and the NTF awarded. I proposed to create an online teaching tool to facilitate the learning required by consultant ophthalmologists and other eye specialists interested in performing refractive surgery (known as laser eye surgery), which eliminates the need to wear glasses. As an eye researcher myself and wife of an ophthalmologist who had spent years in the UK, Australia and the USA, gaining an adequate education both in terms of theory and practice, I understood well the frustrating lack of easily accessible available education within this area and was hopeful that it would be possible to create an online teaching tool for other eye specialists in a similar situation. The ultimate goal was to develop an online course that could be delivered worldwide not only to enhance theoretical knowledge of the subject of refractive surgery, but also to allow valuable practical experiences to be shared online. The latter was dependent, obviously, on the establishment of a two-way communication system between students and tutors and, more importantly, student and student – not always an easily achievable feat with the more mature adult learner.

Seminal guest speaker lectures and other key lectures were sourced and NTF funding was used to facilitate conversion of lectures and PowerPoint presentations into online lecture material, with the help of learning technologists and web designers. Videos of surgery and animations alongside MP3 audio files were created and slowly a vast array of information was available online within the WebCT Virtual Learning Environment. With the extensive input from three ophthalmologists, Antonio Leccisotti, Sunil Shah and Johnny Moore, the essential elements of refractive surgery were identified and

new lectures created or sourced from renowned experts around the world.

Over the past four years the online teaching resource progressed from one module delivered as CPD, to its current state – a PgDiploma/MSc in Cataract and Refractive Surgery (Theory). In addition, the course has seen its first graduates for MSc Cataract and Refractive Surgery (Theory) thanks to the help of the HEA NTF award, world experts who kindly provided lecture material, the continued support from the School of Biomedical Sciences, Campus One learning technologists and web designers, an excellent programme manager and the commitment of three respected ophthalmologists: Professors Leccisotti, Shah and Moore.

The adult learner and lessons learnt

Characteristics of adult learners, influenced in part by their lifestyle, very specifically dictate the educational environment they require to thrive and achieve a programme's learning outcomes. Firstly, the "digital immigrant" status (Bennett *et al.*, 2008) of the majority of adult learners naturally presents significant hurdles within an e-learning environment – a problem which if not addressed very early can often be enough to deter the learner. We found that if induction packs were made available during the initial couple of weeks prior to courses commencing and adequate support and feedback were given on IT related problems, the majority of adult learners adapted well to an online learning environment.

The amount of time any adult learner has to dedicate to education alongside work and family commitments is limited and the flexibility offered by online courses is most certainly key to facilitating learning. Adults tend to have greater variation in learning styles as individual differences among people increase with age. It is essential, therefore, to use a wide variety of teaching materials and methods to take this into account (Rochester Institute of Technology, 2010). Expectations of the adult learners, both of themselves and the tutor, are much higher and many adult learners are highly competitive and are initially reticent to the idea of displaying their level of knowledge in an open forum. All of these traits pose significant problems in promoting engagement with online discussions.

Andragogy (as opposed to pedagogy) refers to learning strategies focused on adults and is interpreted as the process of engaging adult learners, although it is a term to be used with caution as claims of differences between andragogy and pedagogy are the subject of considerable debate (Smith, 1996; 1999). In this particular context, engaging refers not only to the learning itself but also engaging students in terms of affording them the opportunity to direct the learning to include elements of interest to match their specific needs. A champion of andragogy, self-direction in learning and informal adult education, Malcolm S. Knowles has been an influential figure in the adult education field. Knowles himself suggested his success in the area of teaching and learning stemmed from his father's influence on him as a young child and he recalls:

> "Living in Montana and accompanying my father who was a vet, from the age of four on visits to farms and ranches afforded us the opportunity to engage in serious discussions about all sorts of subjects, such as the meaning of life, right and wrong, religion, politics, success, happiness and everything a growing child is curious about. One critical memory from this period in life is that distinct memory of feeling like a companion rather than an inferior. My father often asked what I thought about a subject before he said what he thought, and gave me the feeling that he respected my mind." (Smith, 2002)

Lessons learnt from delivery of the refractive surgery course and also the forensic medicine course online for many years now, include this necessity to respect and nourish the wealth of experience and knowledge individual adult learners bring to an online forum. The lecture content attempts to deliver the essential curriculum, while the discussion forum and topics discussed are left open to the influence of students with tutors being guided by what each cohort of students want to learn more about. The student's ability to control the learning encourages engagement online, and once a pattern of online activity is initiated, students tend to continue to engage and interact with tutors and other students. Our tutors accompany the students on their learning journey and learn with them.

Student questionnaires and module evaluations performed on these

courses demonstrated very similar critical aspects to those outlined by Knowles in his theory of motivating adult learning (Knowles *et al.*, 2005):

- Adults require to know the reason for learning something;
- Their experience, including mistakes they made in the past, provides the basis for learning;
- Adults are most interested in learning the subject with immediate relevance to their work or personal life;
- Adult learning should be problem centred rather than content oriented; and,
- Adults require internal not external motivators.

From the outset, all the online courses were designed to encourage active online engagement and attempted to encourage peer learning through the inclusion of assessed online discussion contributions around problem-centred case scenarios. The Kirkpatrick questionnaire (Kirkpatrick, 1994) was used to evaluate the student learning experience, and uniformly the highest overall yearly grades were achieved by those students who made the most significant and substantial contributions to discussions with peers and tutors. Course evaluations overall demonstrated that the majority of students (>70%) indicated that online discussions enhanced learning. Significantly, students (>90%) agreed that the learning gained from the modules would be used in future work practice, demonstrating the ability of an online teaching tool to facilitate knowledge construction and transfer to the practical setting.

The course team continue to put emphasis on the critical thinking and application of knowledge acquired from lecture material to case scenarios. In many cases, with actively practising ophthalmologists, this includes everyday cases which they frequently discuss online in terms of best clinical management.

Overall, this teaching and learning opportunity afforded only through the award of an NTF has been a valuable and enjoyable experience, both for the tutors involved and for the students, as demonstrated by a student comment: “The extremely valuable discussions of case scenarios with tutors and peers was certainly the highlight of this

course and overall this was a fruitful experience with immediate application within the workplace."

Summary

One of the most important elements of this online learning environment was the discussion forum, where students and tutors asynchronously (not constrained by a specific time or place) shared resources and knowledge and discussed topics related to their learning. This allowed the immediate processing of newly acquired information and its application into everyday practice.

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Dr Tara Moore joined the University in 2001 and is presently a Senior Lecturer within the School of Biomedical Sciences and an active member of the Research Institute. She has been involved in a number of different distant learning courses over the years and has developed a number of online modules for continued professional development as well as fully online Masters courses.

The art of teaching anatomy – a case study

Sharon Conway, Cathal Breen and Karen Fleming

Aims and objectives of the initiative

Anatomy knowledge is integral to the core curriculum for the BSc Hons Radiography and BSc Hons Clinical Physiology cardiology students (QAA, 2001). As evidenced by assessment results (Hall and Durward, 2009), the first year cohort of radiography students and the second year cohort of clinical physiology students often struggle with this aspect of the curriculum. Anecdotally students report that the plethora of terminology and translation of texts to a living individual is inherently challenging.

Traditional anatomy teaching may be regarded as “banausic, didactic, traditional, overly factual” (Turney, 2007: 105), This mechanistic approach promotes student engagement through use of text books, hard plastic models, dry bones and, in some cases, cadaver dissection. Use of cadavers is not an option at the University of Ulster, however dry bones, plastic models and radiographic images are commonly employed. It is questioned if any of these options are effective teaching methods especially as “anatomical models cannot be palpated, auscultated or usefully asked to change position” (McLachlan and Regan de Bere, 2004: 49). This inability to use the sense of touch to clinically examine the plastic anatomical models (palpated) and to listen to internal bodily sounds (auscultated) limits learning possibilities.

The primary learning outcome of anatomy teaching for the health professional groups in this case study is the ability of the students to successfully complete diagnostic examinations on living human beings. It therefore follows that teaching should encourage engagement with the living subject (Rees *et al*., 2005).

Module feedback from anatomy modules highlighted the limitations of traditional teaching methods in radiography and clinical physiology and the overall lack of real body anatomy underpinning knowledge. Hall and Durward (2009) found evidence of surface learning of human anatomy in relation to radiography students,

rather than the deeper learning (Biggs, 1979) that will clearly be essential to a student's competence. The authors therefore considered strategies to promote deeper learning through alternative methods of teaching anatomy.

During a cross disciplinary team visit to Durham University, Professor John McLachlan demonstrated how medical students were successfully using body painting as an anatomy teaching technique (Finn and McLachlan, 2009). This teaching strategy was not previously used in radiography or clinical physiology at the University of Ulster and, while it has grown in acceptance in the education of medical students, there is little evidence that it has been widely adopted for other health professions.

The aim of this case study is to employ an evidenced teaching method which promotes relevance of anatomy knowledge through clinical association, empowering student learning, encouraging deep learning and bringing anatomy to life. This case study provided the baseline knowledge to inform a Centre for Higher Education Practice (CHEP) funded project – Mapping Anatomy – which is introducing anatomy body painting to first year radiography course induction and additionally aiming to enhance transition and the first year experience.

Description of the initiative

Innovative teaching practice dissemination is an element of the Post Graduate Certificate in Higher Education Practice programme offered at the University of Ulster. Two of the authors were on this programme and attended a seminar about discipline specific teaching practices. This prompted collaboration on developing innovative methods of teaching anatomy within the undergraduate programmes of radiography and clinical physiology. A research project developed, 'Flex and Ply', led by Professor Karen Fleming (University of Ulster) and Professor John McLachlan (Durham University) and this was awarded Wellcome Trust funding totalling £122,000. The authors were part of this cross faculty, cross institution research group.

At the start of the cross disciplinary 'Flex and Ply' project, a team building visit was arranged to the School of Medicine at Durham University. At this meeting, there was an opportunity to share research and teaching experience and to observe and to participate in anatomy body painting. This was followed with further opportunities for the authors to perform these techniques at the University of Ulster College of Art and Design in the development of exhibition outcomes.

Gaining experience in the technique (painting self, each other and life models) took some time and developed an appreciation of how challenging it is, and how the hand-eye co-ordination demanded by drawing promotes thinking and learning. This experience gave the authors a different perspective on anatomy. The development of the artwork has led to questioning fixed ideas regarding the underpinning science and will be the subject of further scholarship. Through this process it became clear that there are anomalies in representations in the most widely used anatomy books and in the models currently in use. The authors identified that an added advantage to this type of learning was the 'fun factor' (Figure 1) and this has been confirmed in student feedback (Finn and McLachlan, 2009). When students are relaxed and having fun they are in a 'good place' to learn (Beevers, 2003; Finn and McLachlan, 2009).

Figure 1. Radiography anatomy painting class – enjoying the learning experience.

The students were familiar with traditional anatomy teaching using text books, plastic models, dry bones, physiological data and radiographs. These classes previously tended to be primarily didactic with one way delivery of information from the lecturer. There was limited opportunity to apply any human anatomy knowledge to a living individual prior to clinical experience.

Having gained some knowledge and experience of body painting on ourselves, the authors introduced this technique in selected classes to the first year cohorts of clinical physiology (20 students) and radiography (37 students). Initial approaches involved: clinical examination and marking of bony landmarks related to underlying organs; and clinical examination and painting on the skin surface, bones of the hand, wrist, forearm and face (Figure 2).

Figure 2. Radiography anatomy painting class – facial bones.

This transferred into the clinical physiology teaching as identification of pulses and employment of anatomical landmarks to engage with clinical assessment (Figure 3). The techniques were performed peer on peer in the classroom environment. This was presented to the students as an entirely voluntary exercise with the option of alternative activities, such as drawing the models and copying diagrams. The authors' enthusiasm and participation in anatomy body painting was felt to encourage student engagement in the process.

Figure 3. Clinical physiology anatomy class – identification of pulse points.

Art and Design colleagues' support was essential and, for the larger radiography cohort, there were generally a minimum of two supervising lecturers and, where possible, art colleagues helped to facilitate the first classes. This proved very beneficial and classes where art colleagues were present were generally more interactive and creative (Figure 4).

Figure 4. Radiography anatomy painting of wrist and forearm.

There remained an element of information delivery in the classes via PowerPoint presentations.

The students were given some degree of freedom regarding group sizes. Often groups of two painted each other. Occasionally, larger groups (three to four) elected to have a student, or students, translating information from the books, dry bones and plastic models and then directing the painting. The latter tended to be used for more complex and fine detailed anatomy such as the facial bones, blood vessels and nerves where accuracy is essential.

The radical restructuring of the delivery of this learning at the University of Ulster has had implications for both students and staff members. By integrating body painting to anatomy learning, a more appealing learning method has been offered to the kinaesthetic and visual learners routinely associated with these professions (Fowler, 2002).

Implementation of this learning method required a change of culture from staff, including technicians, and has reinforced the need to involve the whole team in planning effective learning. It necessitated alterations to preparation for the class such as risk assessment, identification of appropriate learning materials and an adequate learning environment – all were vital to the successful promotion of this activity. Classroom or lecture theatres proved inappropriate for this activity, whereas routinely they would have been the preferred space for this topic. This may have implications as we move forward with the University of Ulster Greater Belfast Development Plan. Practical open spaces with access to water fitted the process of body painting best. The learning space has proved to be, and remains, the most challenging hurdle especially for current class sizes of approximately 50 students. The use of mirrors, for the students to visualise the painted anatomy on themselves, permitted conceptualisation of theory and it is felt registered in the deeper learning consciousness of the student.

The biggest transition was from an orderly, passive and relatively immobile student dynamic, typical in large group teaching where a significant amount of 'content' must be delivered, to one where students move around, discuss, compare and debate. Students were notably more conversational with each other and with teaching staff – there was also evidence of uncritical self and peer correction. The sessions were early in the academic year and the social learning environment promoted better familiarity with names and personalities. This method also requires students to touch or feel to confirm anatomy, a new skill that students will do professionally. The painting process is one of emerging confirmation of 'correctness' – errors are therefore positive and, in most cases, are gradually automatically resolved as the student steadily corrects or confirms anatomy. Staff were therefore also challenged in the terminology used to describe the task as students sought to paint anatomical features correctly. It was noted that terms to describe subtle observed and experienced colour and texture features of the body were more dominant than the usual text book anatomical key words that describe function and location.

Initial pilots indicated that the social learning environment these activities fostered would be useful induction experience.

Feedback

This case study is part of an on-going project and therefore interim feedback is presented. To date, student feedback has been gathered through observation, minute papers, field notes, vignettes and a post-it note anonymous 'talking wall'. The feedback has been extremely positive (Figure 5).

Figure 5. Wordcloud student feedback from a radiography anatomy class.

Student feedback has not previously described anatomy sessions as: "interesting", "exciting", "it made learning enjoyable and easier", "when I make a mistake and have to fix it, I will not forget that part of anatomy", "think I will visualise this when doing my exam" and "good fun". There has been no formal method of capturing staff feedback, however the authors have met after the sessions and produced reflective journals.

The majority of students embrace body painting as a method of learning and become engaged very quickly with translation of the traditional materials into tangible results. They now ask in class when the next body painting session will be and there is a general enthusiasm and excitement, which has resulted in remarkably well attended sessions.

It has been mentioned that, when mistakes are made and have to be corrected, the student will not forget that part of anatomy. The students are able to make such mistakes in this environment and to check their result with their peers in a positive atmosphere. Many of the initial errors – such as mapping the carpal bones too proximally – are typical of those reported when students first engage in clinical settings where it is both much more embarrassing for the student and potentially more serious.

It was interesting that students recognised, without prompting, that real human anatomy is very different from the drawings and images that they learn from. There is also a development in student recognition that not everyone is the same (Willan and Humpherson, 1999).

While the risk analysis of products and processes identified extremely low potential for skin reactions, a minority of students are reluctant to 'get dirty' – there may be further research to do on how this impacts on their learning and their practice. Our work with colleagues from the Medical School in Durham suggests that there may be differences between medical students and allied health professional students, or regional factors. Body painting was optional but, having observed some reluctance, we have developed alternatives such as drawing on vinyl gloves, T-shirts and swimming caps. We are not aware of these alternatives being used in this way elsewhere. Unexpectedly, students valued the opportunity to take some of these artefacts away after the class, and they identified them as revision tools. This relates to emerging theories about the value of craft production and renewed importance of 'making' (Harrod, 2007; Potvin, 2007; McCullough, 2010; Richards, 2010). This empowerment of student learning has been an unanticipated and welcome outcome.

It has also been noted that the students develop a professional approach (Warner and Rizzolo, 2006) to each other during body painting. It is anticipated that this will enhance the student experience and professional communication in their first approaches to patients. For those students who are being painted, they also have the opportunity to appreciate how their future patients may feel anonymised, manipulated and depersonalised.

The health professions staff involved have had a positive approach to the introduction of this tactile technique. It is recognised that there is a required change of mindset compared to traditional didactic teaching. Classes are generally much more informal and very noisy allowing the students to be more creative in their learning methods. This has challenged the lecturer to permit this level of freedom to sometimes quite large classes.

Lecturer feedback

Lecturers have to be willing to be painted themselves, especially in the initial introduction of this technique to the students. It is argued that the inhibitions of the lecturer can limit student engagement and ultimate success of the class (Rees *et al*., 2005).

Support of Art and Design colleagues has been crucial to this project, not only to supplement the limited artistic knowledge of the health professionals involved, but also to add value to the teaching. The collaboration has initiated investigation of the visual communication of anatomy. The exchange of ideas and techniques has provided a much richer knowledge of anatomy, which is then conveyed to the student with a view to producing a different sort of health professional (Hampshire and Avery, 2001).

Initially these classes were set up by the lecturers involved and with help from Art and Design colleagues. This proved to be very onerous and time consuming. As the teaching technique has become more embedded in the curriculum, class preparation has become much more efficient. With support from the Head of School of Health Sciences, a central supply of materials is now available and the technical staff are becoming more involved.

The classroom environment and scheduling remain a challenge. There are a limited number of suitable rooms available and the larger class size reduces options further. To fit within the current timetable, classes are generally limited to a maximum of two hour slots and this is not ideal to allow the development of creative learning. It would be beneficial to the students to split the classes into smaller groups, and with a proposed increase in staff levels this could become an option. Overcoming the timetabling issue will require a radical re-think and will take some time to implement.

Development

With development of a pool of resources for this method of teaching, it has been possible to roll out body painting and other tactile anatomy teaching techniques to additional health professions within the School of Health Sciences. Lecturers from other disciplines have had the opportunity of observing and participating in current classes. This has given a much more collegiate focus to the project and developed a larger network of peer support, with the opportunity of interdisciplinary learning. Further classes are planned and input of art colleagues remains central to developing this project further. It is planned to transfer this form of anatomy teaching to encompass deeper anatomical structures and disease by introducing texture and function using textiles. A previous study on medical students (Finn and McLachlan, 2009) has demonstrated a positive effect on anatomy knowledge retention and this is a planned future project for the authors.

Sustainability

The changed practice has already become embedded in teaching in selected areas. There is a move to develop this further into many other areas of teaching of the health sciences. The cost for consumables has been relatively small (currently approximately £400 for 150 students), however time costs initially were high. With development of the appropriate support systems, this type of teaching is now much more achievable in the School of Health Sciences.

It is advisable that anyone planning this type of teaching should first observe the technique and then practice it on themselves or a willing volunteer, before introducing it in the classroom. An appreciation of the process is essential to ensure that learning is enhanced. It is important to identify an appropriate learning environment, complete risk assessments and acquire student consent, especially if photography is being considered.

There is potential for these more varied teaching methods to facilitate the transition of the student into university, thus contributing to reducing the attrition and increasing retention rates. The social aspect of the learning environment necessitates more approachable

staff, as well as encouraging better integration of each student into the class as a whole.

Further comments

This type of human anatomy teaching was initially used for radiographers and clinical physiologists; however it is now being rolled out to occupational therapists, physiotherapists, speech and language therapists and podiatrists. Each profession is developing techniques to suit their own requirements, with the introduction of textiles to demonstrate the feel or appearance of living human anatomy structures such as veins, arteries, muscles and underlying organs.

Transferability into other areas such as translation of medical information into an understandable form for patients is anticipated. Although body painting itself may have limitations in the patient interface, use of textiles to demonstrate how a condition feels, sounds or appears could mean more to a patient than a jargon loaded verbal explanation, or a plastic model which does not resemble that individual patient's anatomy.

As Hermann Joseph Muller (geneticist and Nobel prizewinner) argued: "To say that a man is made up of certain chemical elements is a satisfactory description only for those who intend to use him as a fertilizer." It could therefore be contended that anatomy books, hard plastic models and dry bones do not give the student the rich knowledge of human anatomy that can be developed through this 'learning by doing' tactile method.

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'YouTestTube.com': using user-generated video to engage students

Stephen McClean and W. Paul Hagan

Aims and objectives

We have reported previously through the STAR project at the University of Ulster (McClean *et al.,* 2006), on developments and enhancements made to the teaching of chemistry to year one bioscience students using a raft of measures to support the student learning experience and ease transition. Further reflection on our practice led to a deeper consideration of year one chemistry practical classes, and how these may enhance inclusivity and contribute to students building friendship networks during semester one, particularly in a large year one class. This development is timely in the light of recent articles looking specifically at the delivery of laboratory classes in higher education (Collis *et al.*, 2007, 2008; Adams, 2009).

The main objective of our study was to increase the learning value of these time-intensive resource-expensive teaching sessions, realising that practicals are often forgotten about once the class has ended and the mark and feedback have been received. We considered that prompting critical reflection during and after practical classes may help students to engage better with practical work and see how the material relates to lectures and how it fits with the course content as a whole.

This is no mean task – however looking to popular media provided some inspiration.

Video sharing on internet community sites such as YouTube and Bebo has become very popular in recent times. In addition, video as a tool to capture a physiotherapy student's personal experience of placement has been described (Hellawell, 2007), while the use of video in higher education, particularly in the bioscience field, has also been reported (Badge *et al.*, 2008; Shearer, 2008).

We sought to use the medium of video sharing to promote critical

reflection among undergraduate students as well as building a sense of community early in their academic careers. The nature of the project lent itself well to helping to engender friendship networks in a large first year group (ca. 130) with a broad edudiversity.

Description of the project

A domain name 'YouTestTube.com' was registered and a video sharing website built using Vidiscript software (www.vidiscript.com) which allows for the uploading and sharing of videos in a manner similar to the internet video-sharing website YouTube. A screen shot of the website is shown in Figure 1.

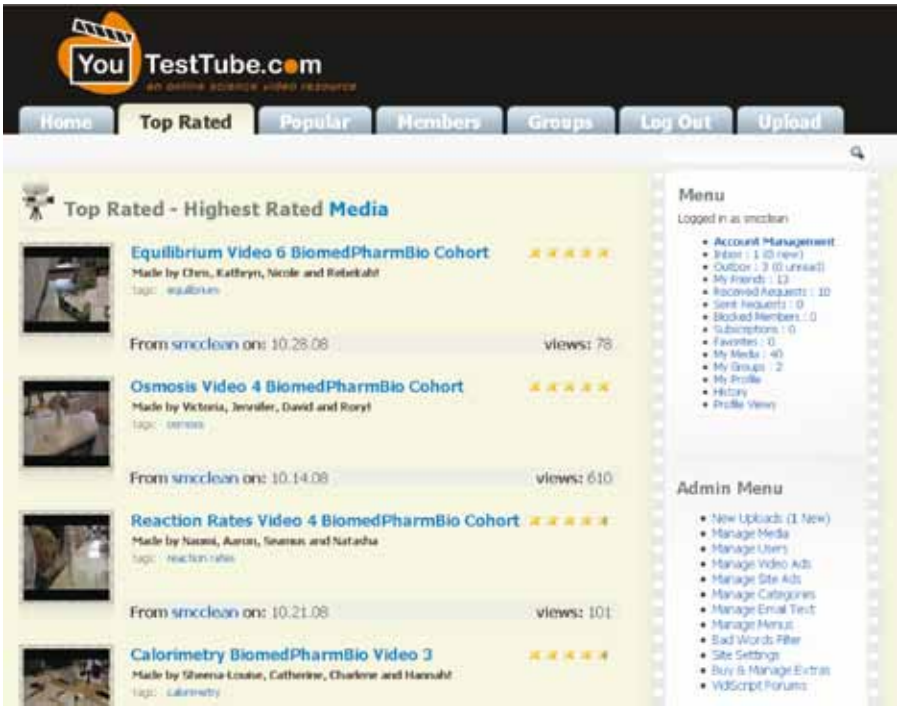

Figure 1. Screenshot of the YouTestTube.com Website.

The site was hosted on a University of Ulster webserver with password protection. Students had to register on the site and join the chemistry practical group before they could view videos. This provided the group with the reassurance that only the students on the module and the module teaching team had access to the site.

Three video cameras were available and provided to three groups of students for each practical session. Students were asked to record their video (around 10 minutes duration) during the laboratory session, paying attention to key observations from the experiments conducted, difficulties encountered and conclusions drawn. They were also asked to reflect on how the skills gained in the key aspects of chemistry fit into their overall program of study. Students were provided with a series of 'reflective prompts' that should be covered in the video and included the following:

- What is this practical all about?
- What skills have I learned?
- How does this practical tie-in with the lectures?
- How will this be important for other parts of my course?
- What parts of the practical were difficult?
- What was most/least enjoyable about the practical?
- If someone else was about to conduct this experiment again, what advice (about the practical) would I give them?

At the end of the laboratory session the cameras were returned to the academic member of staff for downloading of video to a laptop and eventual upload to the server. After each session, students enrolled on the module that had registered on the YouTestTube.com site and signed up for the practical group, could then view, rate and comment on their colleagues' videos.

A prize was given at the end of the semester for the most highly rated and most popular videos. Students were also awarded a small number of coursework marks for engaging in the process of making videos, viewing, rating, making friends, etc. The process was not particularly onerous, as each student had to appear in only one video during the semester.

Evaluation

Feedback was received from students via an anonymous questionnaire as part of module evaluation, at staff-student consultative meetings and through evaluative comments when completing an online questionnaire about their engagement with the process. A total of 105 responses were received via the anonymous

questionnaire where students had to respond to a number of statements with responses ranging from ‘strongly agree’ to ‘strongly disagree’.

Around 86% of students were initially apprehensive about making videos. This is not surprising given that these were year one, semester one students, adapting to life in a much larger learning environment than they had previously been used to. However, by the end of semester, a majority of students agreed or strongly agreed that they enjoyed making the video.

Student evaluation of the technical aspects of the projects is summarised in Figure 2.

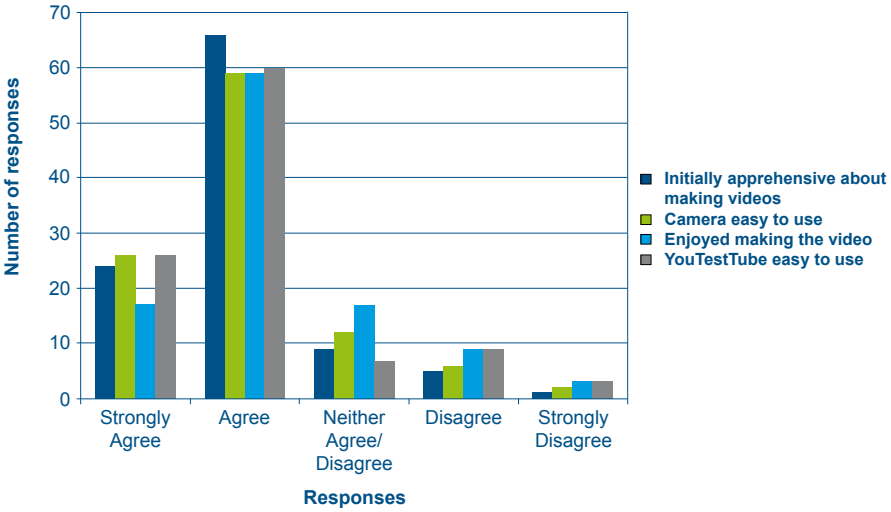

Figure 2. Student responses to technical aspects of the YouTestTube.com project.

Around 81% of students found the camera easy to operate and 82% of students found the YouTestTube.com site easy to use. This came as no surprise, as students in the laboratory needed little instruction on how to use the camera, and the website itself has similar registration processes and functionality to popular social networking websites widely used by students.

Some of the evaluation questions centred on the reflective and social interaction aspects of the project and the responses are summarised in Figure 3.

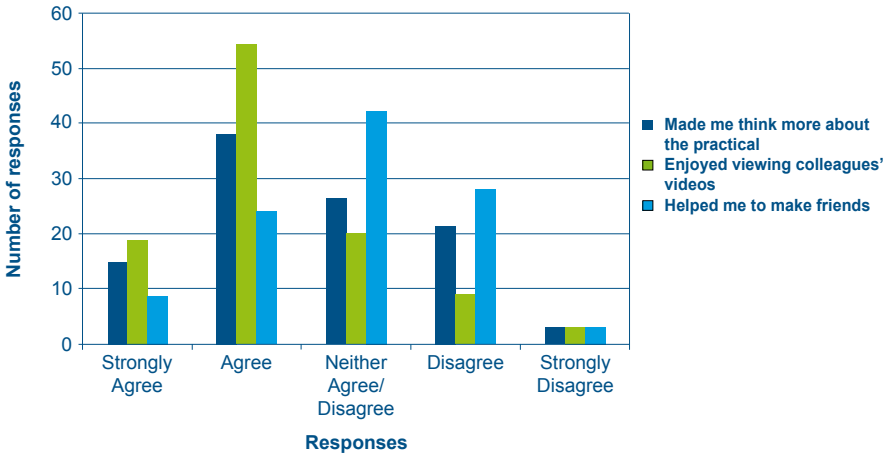

Figure 3. Student responses to reflective aspects of the YouTestTube.com project.

Interestingly, only 51% of students thought that the process had caused them to think more about the practical and how it integrated into their course. Some students expressed the view that the video got in the way of practical work, therefore the decision to restrict the project to one video per student per semester was vindicated, though in a few cases some student groups readily volunteered to make a second video. As backed up by qualitative comments, 69% of students enjoyed viewing other groups' videos, and this was further evidenced by the number of hits on individual videos on the website. The most popular video was viewed over 600 times, while others received in excess of 100 views.

While a large number of social comments were posted on each video, only 32% of students agreed that the practice had helped them make friends within the group; 29% disagreed with the statement and 40% of respondents neither agreed nor disagreed. This statistic was initially surprising given some of the comments received from students such as:

> "Good way to make friends within class."
>
> "www.youtesttube.com is a great way to interact with the class as well as learn from the practicals completed throughout the semester. It is a great idea!"
>
> "I found this site very useful and beneficial as it showed how we could have improved our practical and helped with understanding what happened in the reactions that took place."
>
> "I really enjoyed the experience of making a video, even though when I first heard the idea I wasn't too impressed! The youtesttube site is a great way to review practicals – it's better to see it rather than reading the notes."

The 'make friends' section of the YouTestTube.com site added a powerful social networking angle to the project that had not been anticipated at the outset and will be developed further in future years. Students were able to upload their own avatars, provide a brief biopic and communicate with each other through the online messaging system. Social networking is widely used by university students as evidenced by a MORI report which found that only 5% of the students surveyed claimed never to use it, while 65% said that they used it regularly (MORI, 2007). However, students see social networking sites such as Facebook to be their 'social space' and, as recently reported by Madge *et al*. (2009), they consider such sites should be used primarily for social reasons and not for formal teaching purposes. With that in mind we avoided the use of existing social network sites for this project and branded the YouTestTube site to have its own look, feel and identity. We concluded that while students did not necessarily 'make friends' through the site it did provide a means whereby they could get to know other people in a large year one group (as evidenced by the comments above). Anecdotally we have observed more conversations taking place between students from the different cohorts represented within the module since the project started, though we have not fully investigated if the reflective video project was a major driver of this.

Sustainability

The practice has been fully embedded into the practical classes for the Introductory Chemistry module and the process was repeated successfully during the 2009-10 academic year. Resource costs initially centred on the procurement of cameras and the configuration of the web server used to host videos. However, with the infrastructure in place, the project can run efficiently from year to year. Staff time is required to ensure that students are enrolled correctly on the site, and during the lab session itself staff members allocate cameras to groups of students, and then upload the video to the server at the end of the session.

It is realised that a video sharing website could also be used to deliver video teaching materials, either in the form of pre-recorded lectures made by staff or proprietary video-based teaching materials. In one study where learning support materials were provided to students either as an audio podcast or by video, it was observed that students engaged much better with video materials. Some students felt that the audio podcast format was too akin to entertainment and not fitting for academic study, but video material generated greater interest and engagement from the class (Cann, 2007).

While the YouTestTube project was initially piloted in a science setting, the process could be readily transferred to other disciplines. Video sharing on a social networking site provides a collaborative environment which engenders peer learning and the sharing of resources. It could be effectively used in distance learning courses or for students on placement, and the social network function could allow for peer assessment of presentations or debates.

Other applications of this approach could be:

- Filming of student presentations for peer assessment;
- Student generated video documentaries for peer learning exercises;
- Video diaries of placement experiences followed by reflection using the online commenting system;
- Gathering video resources from the internet for sharing with the module group;

- Video of debates and discussion on ethical issues; further discussion could then take place online; and,
- 'Day in the life' videos for new students coming to university.

Resources

There is a resource list available from the UK Centre for Bioscience to support the use of digital video in teaching and learning which includes examples from other disciplines apart from the Biosciences. http://www.bioscience.heacademy.ac.uk/ftp/events/repforum09/video.pdf (accessed 19 May 2010).

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Origami: a versatile vehicle for in-lecture activity and outreach dissemination

James Davis, Laura A.A. Newton, Ray Leslie and Peter R. Slater

Introduction

Origami has been used extensively as a teaching aid for mathematical sciences (Mitchell, 2005) but its extrapolation as an educational tool beyond this remit has remained largely under-utilised. Although an art form in its own right, its association as a child's toy/activity can serve as a non-threatening foundation from which to capture the interest of a wide age range. There is little doubt that the models can provide a sense of challenge and fun but there is also an opportunity to use the medium as a vehicle through which to reinforce lecture material. The exploitation of an origami model essentially as a framework upon which to hang snippets of information (facts, schematics, formulae, etc.) could have the prime benefit of engaging the student, while enhancing the transfer of the information contained within the puzzle. The principal question that is addressed in the present communication is whether origami, or certain aspects of it, could be rendered in a more generic format. The intention being that it could be harnessed simply as an engaging activity for transmitting information or reinforcing key concepts and thus be a useful adjunct to teaching practice irrespective of discipline.

There is a vast array of origami models from which to choose and they can range from the trivial to highly complex engineering designs. In principle, and with a bit of imagination, it is very probable that a model could be found to suit any particular lecturing situation. This may, however, require substantial effort in both locating an appropriate model and ensuring that it would be appropriate for the students to construct within an appropriate time frame without becoming disillusioned. The principal rationale adopted here was to find a single system that would be sufficiently flexible – allowing the addition of contextual material with a minimum of effort. Modular puzzle systems were selected on the basis that, while the assembly is relatively simple, and thereby accessible across a range of ages and skill levels, they also possess a degree of difficulty in their

solution and thus provide a challenge. More importantly, they can have a relatively large surface area upon which the contextual information can be placed.

Another important design factor was that the system should not only be capable of relatively speedy implementation, but that it also be inherently adaptable, such that it can keep pace with the ever evolving course curricula. The design and construction of one such puzzle system is described and the result of a preliminary evaluation of its implementation is presented. The aim of the present communication is not to provide an in-depth examination of its use within one context, but rather to highlight the potential for exploiting the puzzle nature of an origami construct as a means of capturing student interest through engaging their curiosity. An educational tool is therefore presented based on the development of a generic template for the adaptation and deployment of the models.

Model methodology

The remit was to develop a system that would be interactive, fun and challenging whilst allowing for a range of abilities. The puzzle was constructed from a series of six A4 sheets – pre-printed with the core information elements (Figure 1) that constitute the learning outcome aspect. The modules can then be combined to yield a cube as indicated in Figure 2.

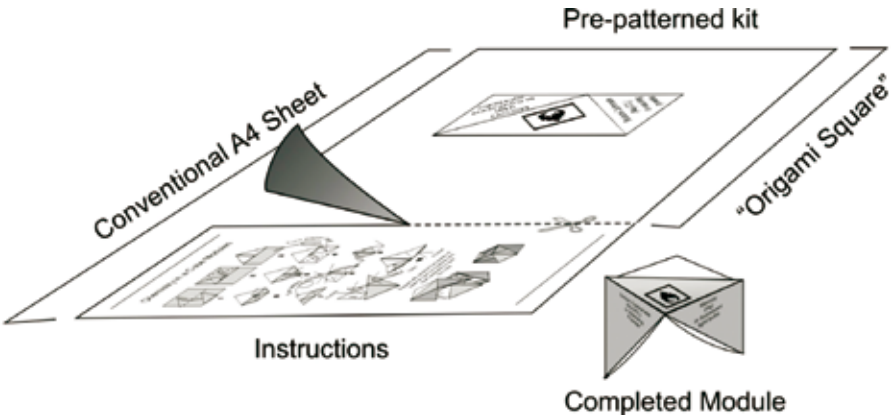

Figure 1. The 'origami kit'.

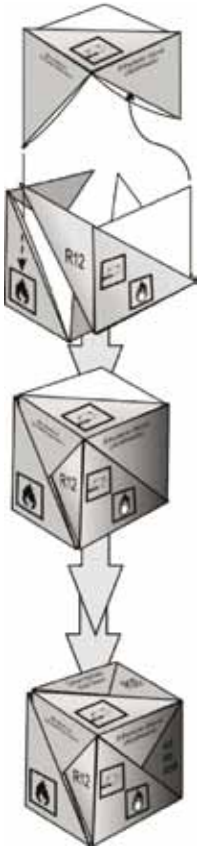

Figure 2. Assembly of the COSHH Cube.

Each face of the cube can carry the information and is comprised of three distinct parts – each derived from a different module. The model thus presents two challenges – the assembly of the cube and ensuring that the three information snippets contained within each completed face are complementary. The process is similar to the Rubik's cube type puzzle though technically much easier. The degree of difficulty can be attenuated and is discussed in subsequent sections. It could be envisaged that a single form could be used at multiple levels – as a fun lecturing interlude but one which can focus the class and reinforce the core material (Mayer and Gallini, 1990; Mayer *et al*., 1996). The 'take away' nature and trophy status could also serve as an important aide-memoire to the students.

An example system was created whereby the aim was to develop an appreciation of key Control of Substances Hazardous to Health (COSHH) hazard symbols and the associated warning data that identifies the particular risk. This is the first step that every student within the physical sciences is required to take, and which most employees irrespective of job description should be encouraged to undertake (Lehto, 1998). Presenting such information in an accessible format that engages the interest of the latter, and yet is easily disseminated, has been identified as a major problem (Philips *et al*., 1999) and hence its selection as a potential target in the present evaluation.

Six chemicals used in everyday consumer products were selected as the key examples for the trial on the basis that they would reinforce the need for constant vigilance – even when dealing with products that would not normally be regarded as containing a 'chemical' or indeed recognized as being one. The six chemicals and the application examples are listed in Table 1 and were selected on the basis that they provide a range of dangers through which the various hazard symbols and Risk (R) phrases could be more fully illustrated.

Chemical	Application	Hazards
Butane	Hairspray	Flammable, R12
Ethylene Glycol	Antifreeze	Toxic, R23
Hydrogen Peroxide	Hair Dye	Corrosive, Oxidising, R5, R8, R35
Mercury	Fluorescent Lighting	Toxic, Danger to Environment R23, R50/53
Sodium Carbonate	Washing Powder	Irritant, R36
Sodium Hydroxide	Drain Cleaner	Corrosive, R35

Table 1. Puzzle components and respective properties.

Preliminary trial

An initial trial was conducted with university undergraduates (N=23) and a section of the cleaning staff (N=14) to assess the accessibility of the puzzle, the clarity of the instructions, general skill level needed to complete it, time required for completion and the response to the activity. The results of the activity were assessed by questionnaire – the evaluation relating predominantly to the accessibility and utility of the puzzle itself and by general interview after the activity.

Results and discussion

The main problem associated with integrating such activities into conventional educational processes is that the process can fail to engage the participant and can subsequently 'poison' the experience. There is a danger that the participant can be disillusioned by the activity if it appears too complex or they are confused by the pictograms on the instructions. This is especially true in the case of more elaborate platonic model systems where the number of assumed steps between pictograms can be too great, and can be a particular problem for the beginner (Marcus *et al*., 1996). The advantage of the system presented here is that it utilises a modular system in which the folding of the individual components is very simple in comparison to many of the other platonic origami models. Issues over the clarity of the actual instructions were resolved through the provision of a video clip of the entire assembly process, as a means of reducing the cognitive load from one stage to another (Marcus *et al*., 1996; Novick and Morse, 2000).

The assembly of the components provides the puzzle element: the level of difficulty clearly increases and can require a modicum of patience and perseverance. This is unavoidable as there must be a challenge element to the puzzle in order to instil the sense of achievement. The trophy status of the final model provides an ideal route by which to transfer the message and it could be expected that such positive reinforcement would in turn boost the participant's motivation to learn, and aid subsequent information recall. The puzzle was generally completed within 20 to 30 minutes – from initial construction of the modules to the final assembly of the cube. There was no difference between the two cohorts in terms of ability to construct the puzzle with no failures.

A central requirement in the development of such activities is that they must also be deemed to be a worthwhile diversion that provides a notable benefit, which is complementary to the core educational message being delivered (Lehto, 1998; Philips *et al*., 1999). In the present example, the information contained within the puzzle was found to be of genuine interest in that many of the group did not realise the potential hazards possessed by an 'everyday' chemical. All of the participants found the puzzle to be informative and confirms the efficacy of the system as a vehicle for, at the very least, stimulating interest (Figure 3). While the activity was regarded as enjoyable and recorded as such on the end of session questionnaire, the most telling evidence, however, was the fact that each participant retained their 'COSHH Cube' after the event. The construction of the components, and the final assembly to yield a tangible three-dimensional model, provided a sense of achievement but could also serve as an important aide memoire. Over 90% of those taking part in the pilot study retained the cube with the intention of showing it to friends and family. This can be viewed as a particularly positive outcome in the present test context, as it helps to disseminate the significance of hazard awareness to a broader audience and serves to reinforce it within the working environment (Lehto, 1998; Philips *et al*., 1999). This also highlights the potential use of the origami activity as a wider dissemination vehicle which can extend beyond the borders of the classroom/university environment into the home.

The main challenge was not the assembly of the cube but rather the assembly of the modules in the appropriate order, such that three information snippets were matched correctly. The difficulty associated with the latter process can be mediated through colour coding the information, so that each side would be a specific colour upon successful completion. This is analogous to the Rubik's cube approach, and removes the ambiguity of determining when the puzzle is correct. The participants know where the components should go. Removing the colour coding increases the challenge substantially in that the participant must then seek additional information sources for confirmation that the three components of information within a given face are in fact complementary. It is simple to assemble the cube in such instances, but the information

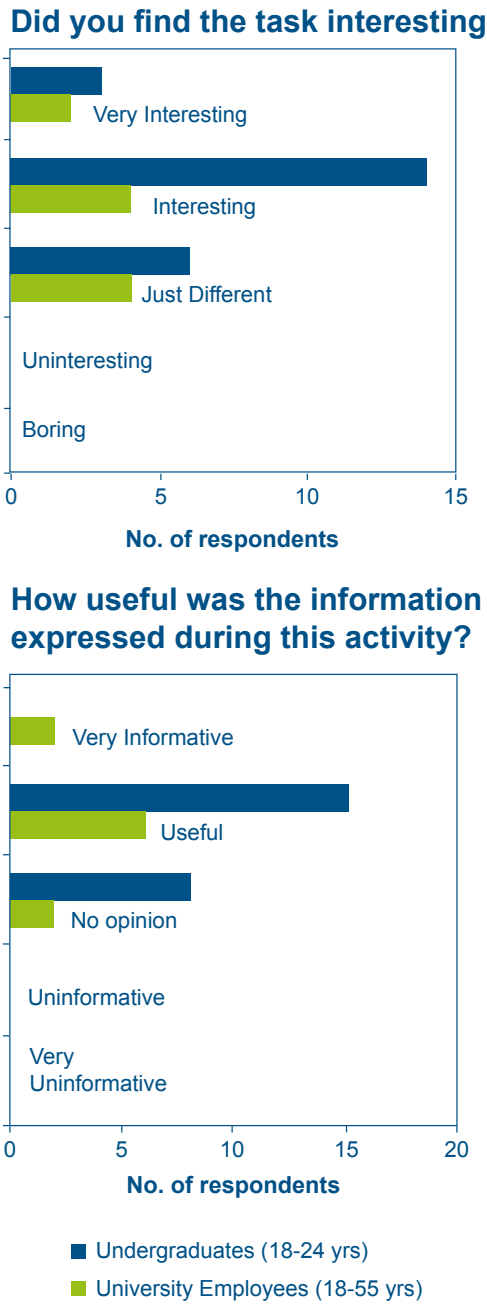

Figure 3. Feedback questionnaire responses on the COSHH Cube activity.

conveyed on a given face could easily be false. This creates an inherent danger if that approach were adopted and deployed as a self-learning aid without the answers being supplied. It does however have considerable merit in a coursework format where it can be used to induce the participant to search for and use additional information sources or complete a calculation to ensure that the three variables are consistent. The former was utilised in the trial where the participants had to identify which symbol and R phrase belongs to a particular chemical.

A key strength of the system advocated here is that the kit can be produced on demand. The cube designs were created in PowerPoint with the file essentially serving as a template. It is then simply a matter of cutting and pasting the information onto predefined sections (Figure 4).

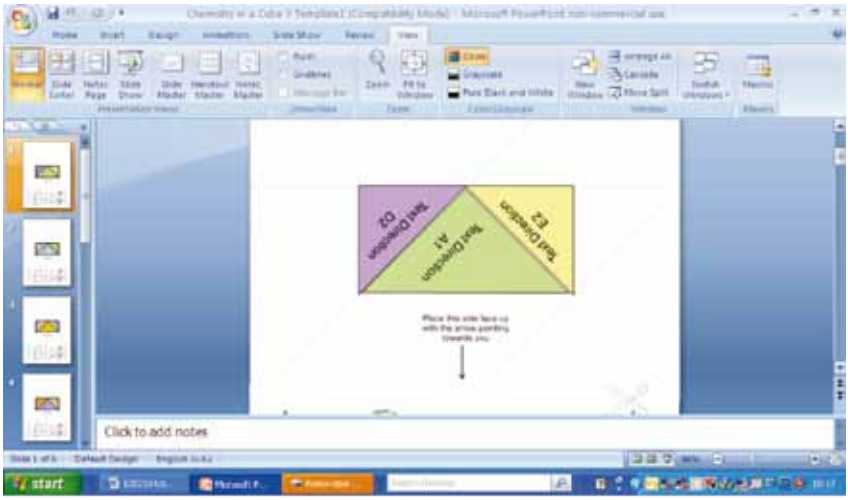

Figure 4. Screenshot of the origami puzzle template.

The core advantages of the proposed system are:

- It provides an enjoyable activity through which students of varying age and ability can participate;
- The activities do not require any form of specialist equipment, are completely safe and can be conducted in a variety of locations – in the lecture theatre or home (coursework);

- The resulting models provide a tangible and adaptable resource that can be tailored to the requirement of the lecture or tutorial;
- The system is readily transferable between disciplines;
- The sense of achievement can encourage positive reinforcement of the core messages; and
- The 'trophy' status leads to an inevitable retention of the model and transfer of message beyond the initial lecturing session, and offers an opportunity to stimulate wider interest and debate.

Conclusions

The system developed is generic, deliverable through electronic means, transferable and simply requires access to a printer in order to generate the core components of the puzzle. As such, it provides a zero cost alternative that could easily be adopted with the template proving a convenient method of incorporating new contextual material. It offers an engaging activity that can be applied across a wide audience – student, employee or the wider public. The project creates a versatile vehicle for stimulating user involvement and discussion which is essential for improving the dissemination of core facts and can encourage positive reinforcement to facilitate retention and recall of these facts.

Supplementary material

Templates and instructions for the assembly of the cube are available from the authors, along with video clips detailing the folding of the cube.

Acknowledgement

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Should I stay or should I go? Attendance and attainment in first year modules

Peter Green, Michael Pogue, Gregory McGrath and Abbey Wilson

Introduction

The current learning environment encountered by first year undergraduates has undergone a significant transformation in relatively recent times. Government policy to increase university participation has resulted in significantly larger class sizes whilst universities themselves, in attempting to enhance their financial position, have actively recruited in foreign markets thereby increasing the numbers of students from ethnic minorities. Perhaps of more significance in influencing student attendance has been a major shift in the mode of lecture note delivery accompanied by a significantly increased cost associated with a university degree. Students now expect lecture notes to be available electronically through virtual learning environments and often appear to be using electronic delivery as a substitute for, rather than a complement to, lecture attendance (Grabe, 2005; Latreille, 2008). In addition, the increased fees demanded for university degrees has undoubtedly imposed additional financial pressures upon students, making part-time employment a necessity for the majority of students, thereby encroaching upon study time.

Literature review

An expansive body of literature has developed surrounding the identification of significant variables in providing an explanation of student performance in third level education (see Newman-Ford *et al.,* 2008 for a useful review). Empirical evidence suggests that student non-attendance is a universal problem transcending country, university and discipline. In turn, a myriad of reasons have emerged to explain absenteeism with an attempt to classify these reasons into intrinsic (motivation, ability, learning styles), extrinsic (financial pressures, family commitments, assignment deadlines) and lecture (quality, value, interest) factors being suggested by Latreille (2008).

The primary focus of the developing literature has remained firmly upon the impact of non-attendance on performance with increasingly

sophisticated methodologies being applied to the data which is often now gathered by electronic means. The majority of studies utilise a regression methodology and report a Pearson correlation coefficient together with statistical significance as the primary measure of association between attendance and performance. More recently, panel data approaches have been employed in attempting to isolate the impact of non-attendance (Rodgers, 2001) and other applications have included production function models (Yakovlev and Kinney, 2008) and econometric models (Guney, 2009). It has also been suggested that the use of electronic recording systems avoids some of the problems intrinsic to paper-based attendance monitoring and manual data entry (Newman-Ford *et al.*, 2008) including, inter alia, personation, not signing in, illegible signatures and causing distraction during class.

Earlier work by Jones (1984) tested four models explaining the relationship between attendance and performance – the motivational model, the ability model, the attendance model and the achievement model – finding that the data provided the strongest support for the attendance model. Romer (1993) examined the relationship between attendance and performance in an intermediate economics module and argued: “Simple ways of controlling for motivation and other omitted variables have only a moderate impact upon the relationship between attendance and performance”. Similarly Devadoss and Foltz (1996) investigated the impact of numerous variables including student motivation and aptitude together with lecturer characteristics and concluded, after controlling for other factors: “The more classes a student attended, the better the student’s grade”.

Subsequent studies reported statistical measures of the strength of the relationship usually in terms of the correlation between attendance and performance. Paisey and Paisey (2004) reported an overall correlation of 0.58 between overall performance and overall attendance, with lecture attendance proving a better predictor than seminar attendance. Halpern (2007) examined whether attendance per se is an accurate predictor of academic achievement or whether student characteristics are better predictors and attendance is merely a consequence of such characteristics. The module chosen was assessed entirely by coursework which could potentially

weaken the association between attendance and performance. A correlation coefficient of 0.502 between attendance and achievement was reported which is significant at the 0.01 level. However of the other variables investigated, relevant work experience and A-level entry grades appeared to be of greater significance. Halpern concluded that such evidence would not justify implementing a policy of compulsory attendance. A different approach was taken by Gump (2006) who examined the relationship between the importance that students attributed to attendance prior to commencement of their studies and their subsequent attendance. A significantly positive relationship was identified with a correlation coefficient of 0.174 reported which is significant at the 0.05 level. On this basis he concluded that students should be encouraged to develop a positive attitude to the importance of class attendance which can be reinforced by academics making their lectures as useful and motivating as possible. Guney (2009) applied an econometric model to an undergraduate accounting module solely taken by non-accounting students and discovered a very strong link between class attendance and performance.

Finally Colby (2004) identified a number of key trigger points referred to as the 70% and 80% rules. The former is defined to be "If a student does not attend at least 70% of teaching sessions they will have a two in three chance of failing, and a four in five chance of not getting a first or upper second." Similarly the 80% rule is defined as "If a student does not attend at least 80% of teaching sessions they will have an even chance of failing, and a two in three chance of not getting a first or upper second." Colby also suggests that if a student misses a session within the first two weeks of the academic year then this is often a precursor for attendance problems and poor performance.

Data description and statistical analysis

The attendance data employed in this study were collected in a one semester, introductory financial accounting module (Business Accounting I) taught separately in different semesters to cohorts of students enrolled in the first year of the BSc Accounting and BSc Business Studies degree programmes respectively. There were usually two lectures and one seminar per week except in those

weeks when summative assessment in the form of class tests occurred. Attendance data for both lectures and seminars were collected using the electronic Turning Point system for lectures and manual recording for seminars. In total, 102 students (54 male and 48 female) from the BSc Accounting degree and 121 students (49 male and 72 female) from the BSc Business Studies degree were included in the study.

Further information regarding individual student characteristics was obtained from questionnaires completed when students met with their academic studies advisers during the semester. In particular, details concerning part-time employment commitments, hours of personal study, residence and prior education (grammar, secondary) were obtained. This supplemented already available data regarding gender, age and entry points.

Attendance	0-29%	30-49%	50-69%	70%-89%	90%-100%	Total
Accounting	2	7	13	51	29	102
Business Studies	8	17	40	40	16	121
Accounting %	2	7	13	50	28	
Business Studies %	7	14	33	33	13	
Accounting Average Mark	0*	55%	51.62%	73.12%	75.21%	68.29%
Business Studies Average Mark	25.25%	38.18%	50.8%	56.48%	64.87%	51.06%

*Neither student took the class tests

Table 1. Descriptive analysis of attendance and class test performance.

Table 1 does indicate that students who attend more classes do achieve better results with the only exception being a slight deterioration for accounting students attending 50% to 69% of classes. The evidence suggests that accounting students are better attendees and achieve higher marks (see Table 2) when the two cohorts are compared. This may be also explained by a variety of other contributory factors including higher levels of motivation (as a

consequence of perceived relevance to degree program) and prior academic achievement (higher entry requirements). Data were also gathered to investigate the variation in the level of attendance during each week of the semester and are presented in Figures 1 and 2 below for each cohort of students.

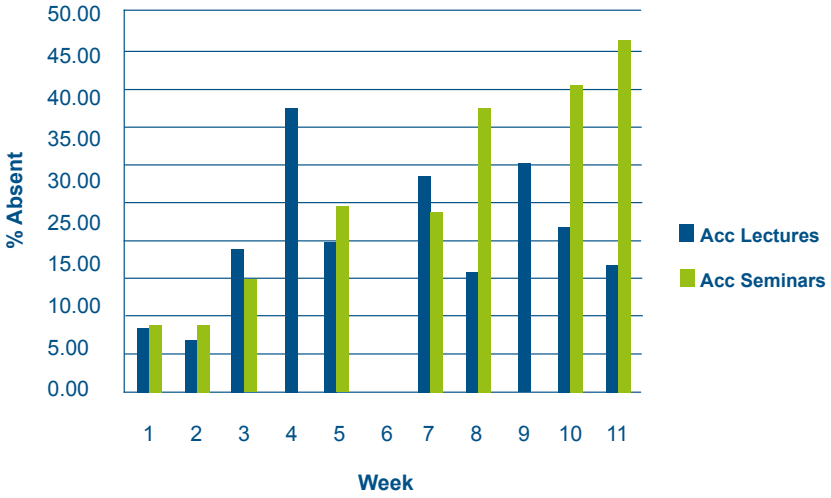

Figure 1. BSc Accounting absenteeism by semester week (%).

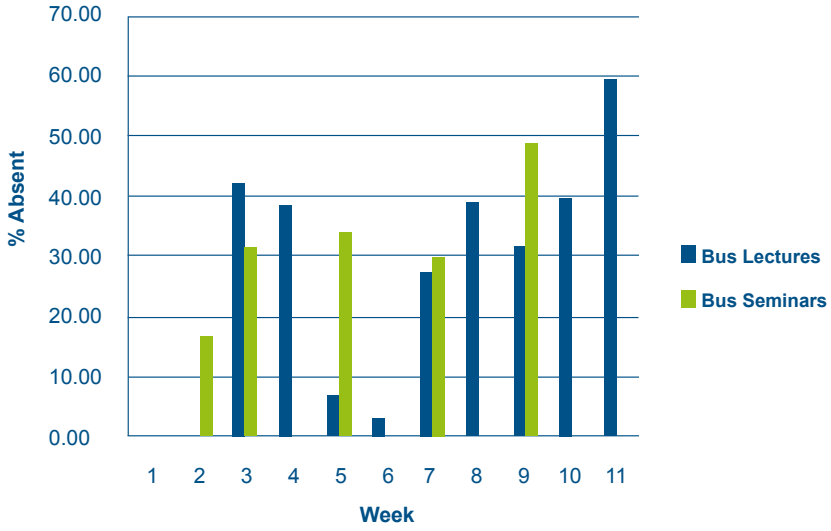

Figure 2. BSc Business Studies absenteeism by semester week (%).

Figures 1 and 2 reveal that for accounting students both lecture and seminar attendance is initially high and exhibits a gradual reduction during the semester which is more pronounced for seminar attendance. In contrast, lecture attendance for business studies students peaks in mid semester and shows a marked deterioration towards the end of the semester. The differing attendance patterns may, to some extent, be explained by the different semesters in which the two cohorts are taught, with the second semester interrupted by the Easter vacation. The overall impression is again that attendance levels are higher for accounting students. The average attendance for accounting students was 79% whereas for business students it was 65%. The weeks for which there appear to be no absenteeism correspond to the occurrence of class tests by which the module is assessed. In addition, attendance by gender was also examined with results shown in Table 2.

Gender	Male	Female
Accounting	75 (67)	82.5 (73)
Business Studies	59 (46)	69 (55)

Table 2: Average attendance and (examination mark) by gender (%).

Table 2 reveals that female students in both cohorts attend more classes than their male counterparts and also achieve a higher level of performance.

Regression analysis

Initially a scattergram was constructed plotting examination performance against attendance for both degree cohorts (Figures 3 and 4).

The indication for both cohorts is that of a positive relationship between attendance and module performance (correlation coefficients of 0.54 and 0.59 respectively). The results obtained are very similar to those previously reported by Paisey and Paisey (2004) and Halpern (2007). Subsequently a binary logistic regression analysis was performed to model the impact of attendance along with various other factors as determinants of failure in at least one module in Semester 1. This was performed on

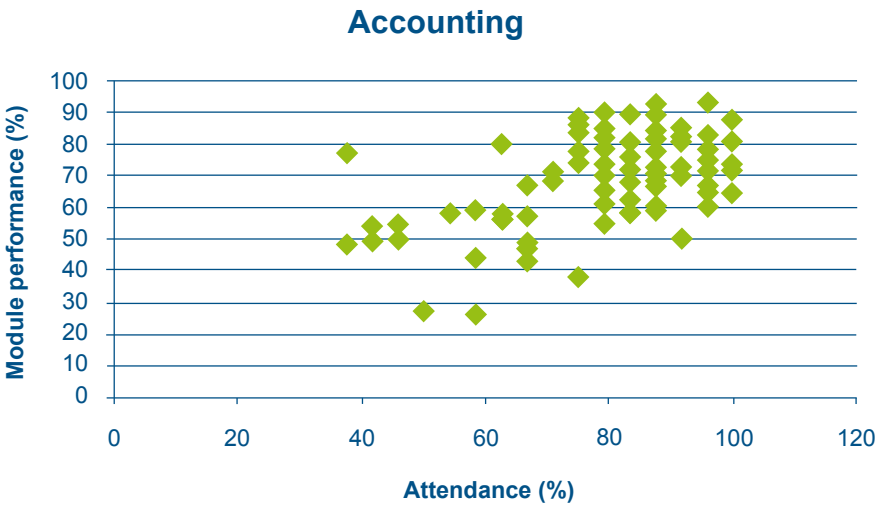

Figure 3. BSc Accounting attendance and performance.

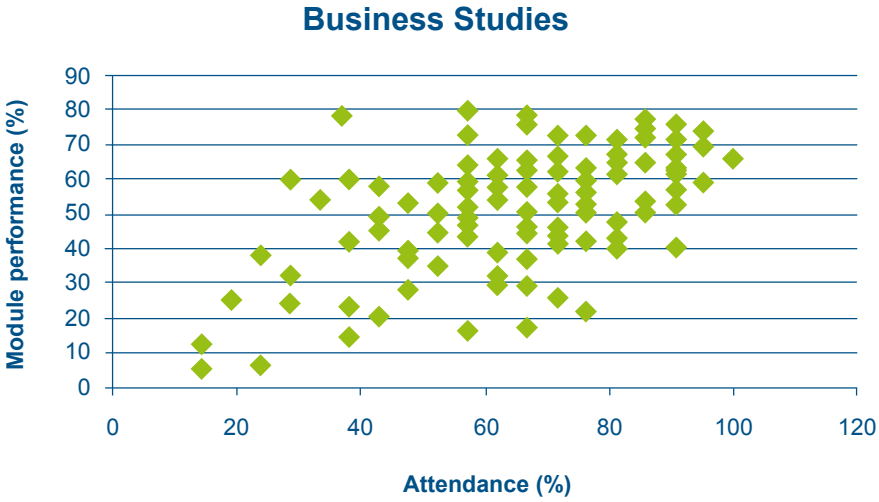

Figure 4. BSc Business Studies attendance and performance.

the total sample of all students (accounting and business studies). Whilst it could be argued that the two samples differ, this approach was chosen because the number of students in some categories (for example mature students) would be very low. The data used related to two modules for accounting students (Business Accounting I and Accountancy Today) and three modules for business studies students (Organisation Studies, Economics and Management Skills). The results obtained are shown in Table 3.

VARIABLE	SCORE	Degrees of Freedom	Significance
% Absenteeism	17.403	1	**.000**
Time spent studying	6.743	1	**.009**
Double award entry	4.499	1	**.034**
Entry Tariff Points	4.312	1	**.038**
Part-time work (> 12 hours)	3.494	1	.062
Friend studying at campus	3.247	1	.072
Parent attended university	1.940	1	.164
Relevant prior study	1.832	1	.176
Residence (home/halls)	0.720	1	.396
School attended (grammar/secondary)	0.582	1	.445
Mature student	0.269	1	.604
Gender	0.021	1	.883
Sibling attended university	0.015	1	.903

Table 3. Factors influencing performance.
(Bold indicates significant at the 0.05 level of probability).

From Table 3, four variables are identified as significant at the 0.05 level and two variables at the 0.01 level. The most significant variable relates to attendance with time spent studying outside class contact time also being significant at the 0.01 level. The other significant variables at the 0.05 level are two variables relating to prior academic achievement, i.e. entry tariff points and whether there was a double award entry (vocational A-level).

Conclusion

A myriad of factors have been suggested in the academic literature attempting to explain student performance at university. Arguably the principal cause of poor performance is poor attendance at class which, in turn, is influenced by a further group of variables. Some of these relate to the individual student (academic ability, financial pressures, family circumstances and motivation), others to course structure (timing of lectures, assignment deadlines, class size and mode of delivery) and the classes themselves (lecturer ability, perceived value, interest).

In this study the focus has been on first year students who may face additional pressures of adjusting to university life, living away from home and uncertainties about the chosen degree program. It is clearly crucial that such students are made aware of the importance of attending classes in improving potential academic achievement in both first year and beyond. Poor attendance in first year in prerequisite modules can have ramifications in terms of subsequent performance, degree classification and indeed employment prospects. There is clearly significant potential for future research in this area by tracking these students through the degree programs, comparison with other degree programs in other faculties and perhaps simply asking students why they are absent from class (Moore *et al.,* 2008).

Responsibility rests with the academic staff to stimulate students in the lecture theatre and also with the university to ensure adequate student support facilities are readily available.

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Gregory McGrath has been a Lecturer in the University of Ulster since 1991 and has been Course Director of the BSc (Hons) Accounting degree since 2004. He has presented papers at Irish Accounting and Finance Association conferences and the British Accounting Association SIG on accounting education.

Abbey Wilson graduated from Queen's University in 1999 and returned to do the MSc CAP programme in Ulster the following year. Since then she has worked in marketing and business development roles before taking up the post of Student Achievement Advisor within the Department of Accounting in 2007.

Using the Wheel of Life and Health to help first year students adjust to university life

Greg Kelly and Mark Poulter

Introduction

The transition from secondary to third level education can be something of a 'culture shock' for first year students. Social life may take precedence for those who have never been away from home before while others may find that they need to devote more time to academic studies just to keep up with their peers. However, Chow (2007) found that students who experienced less stress by achieving a balance of work, school and social life were able to perform better academically. There is also evidence to suggest that their perceived satisfaction with their performance may play a key role in determining positive personal development (Home, 1997; 1998). This paper describes the development of the Wheel of Life and Health, an interactive online tool developed at the University of Ulster to help students chart their current, perceived competence in different dimensions of university life to help them visualise these in one easy-to-follow visual display.

The Wheel of Life

The original Wheel of Life is an ancient symbol over two thousand years old. It was painted at the entrance to every Buddhist temple and monastery. The first circle of the Wheel is a mirror believed to reveal the inner self. The second circle assisted the individual in making a choice. Similar concepts can, indeed, be found in a variety of religious and spiritual cultures (Byrne, 2005).

The Wheel of Life has been adopted, more recently, by life coaches as a way of portraying life as segments of a circle, with each segment labelled to represent different areas of life such as health, career, personal life, and so on. The degree of satisfaction in each area is graded, with, typically, 10 representing fulfilled and satisfied, 5 meaning significant room for improvement and 1 suggesting total unhappiness. For example, Rogers (2004) uses a wheel of life to clarify goal setting for clients. However, such life coaching wheels of life do not necessarily reflect the main concerns of student life, focusing, as they tend to do, on career, spouse and money.

Parker *et al*. (2008) suggest that academics should be aware of the importance of self-concept when working with university students regarding their satisfaction with life. However, they also need to be aware of how students are assessing their self-concept. Parker *et al*. (2008) found that self-concept is not only important in predicting life satisfaction but also suggests what areas of student life are important to students.

Re-inventing the Wheel

Taking the Life Coaching Wheel of Life as a starting point, a development team of staff and one student, from the Faculty of Life and Health Sciences began a process of iterative development. This was facilitated through the Centre for Excellence in Teaching and Learning (CETL) Institutional E-Learning Services (CIES) Reward and Recognition Scheme, in partnership with the CETL for Reusable Learning Objects (RLO) incorporating London Metropolitan University, the University of Cambridge and the University of Nottingham. After a two day residential workshop, the team finally created (on paper) a potential student self-development tool: The Wheel of Student Life (WHEESL).

A simple student-focused adaption of the Life Coaching Wheel of Life was initially proposed which would have seen the wheel's eight spokes labelled with headings relevant to student life (e.g. Academic; Business/Career; Fun and Recreation; Finances; Health; Family and Friends; Relationships; Personal Growth). Two main shortcomings were identified: lack of objectivity (being, as it would be, a subjective estimation of the student's own competence in these eight areas) and lack of self-improvement material (should a student wish to 'improve' on a particular spoke, there was nothing provided to facilitate this).

It was then felt that, to solve the subjectivity, a mini quiz comprising ten questions could be created for each spoke; this would then provide an objective measure of a student's state of spoke-related knowledge. A student's mini quiz scores, once entered on the spokes, would then produce a wheel representing an objective measurement of knowledge, rather than a subjective estimation. As for the lack of self-improvement, it was felt that a study package

(ideally a brief, engaging, interactive, online study package with self-evaluation questions at the end) could address this.

Next, in considering such 'self-improvement', it was realised that the areas considered 'in need of improvement' might vary depending on who was doing the considering. It is quite possible that the perspective of a particular student (possibly interested in developing socially) could be very different from that of his/her lecturer (whose focus might be more on academic development). It was thus felt that a subjective satisfaction rating should be included alongside the objective knowledge rating.

The next iteration combined all the above. An initial 'subjective estimation of knowledge' wheel would be created, and this would then be followed by the creation of an 'objective measurement of knowledge' wheel after completing one mini quiz per spoke. The juxtaposition of the subjective and objective ratings would, hopefully, focus attention on any actual areas of deficiency, which would then give a good basis on which the student could then complete a third wheel – rating his/her satisfaction with each spoke's score. The provision of interactive study packages for each spoke would then enable the student to address any area where a lack of knowledge was causing dissatisfaction.

In considering the topics that such learning packages should cover, the final iteration was arrived at. It became apparent that each spoke of the main wheel could house a sub-wheel of its own, and each sub-wheel's sub-spoke could also house a sub-sub wheel… and so on. As illustrated in Figure 1, if the main wheel has a spoke labelled 'Academic', this could itself house an entire sub-wheel with sub-spokes such as 'Essay Writing', 'Learning Styles', 'Referencing', 'Exams', etc. Furthermore, the 'Exams' sub-spoke could, in its turn, house a sub-sub-wheel with sub-sub-spokes such as 'Revising', 'Exam Technique' and 'The Night Before' (e.g. how much sleep to get, what to eat, etc.). In this way, an almost limitless amount of information could be organised and utilised in a logical manner. A web of wheels could be created, with those on the very extremes of the web having a mini quiz (and learning package) for each spoke. The mean spoke score for each wheel would then be taken

and used as the score for the relevant spoke of the next wheel up the chain. This process would be continued until arriving at an overall score for the main Wheel of Student Life (WHEESL). To begin with, this WHEESL would be predominantly the result of subjective estimates by the student of his/her competence in each of the WHEESL's main spokes. However, as the student works through the end-spokes' learning packages (stimulated to do so by the above-described juxtaposition of subjective estimation followed by objective measurement) the WHEESL becomes more and more a valid representation of the student's objectively measured competencies. However, the WHEESL is a much longer-term project, the first steps of which have been taken by creating The Wheel of Life and Health.

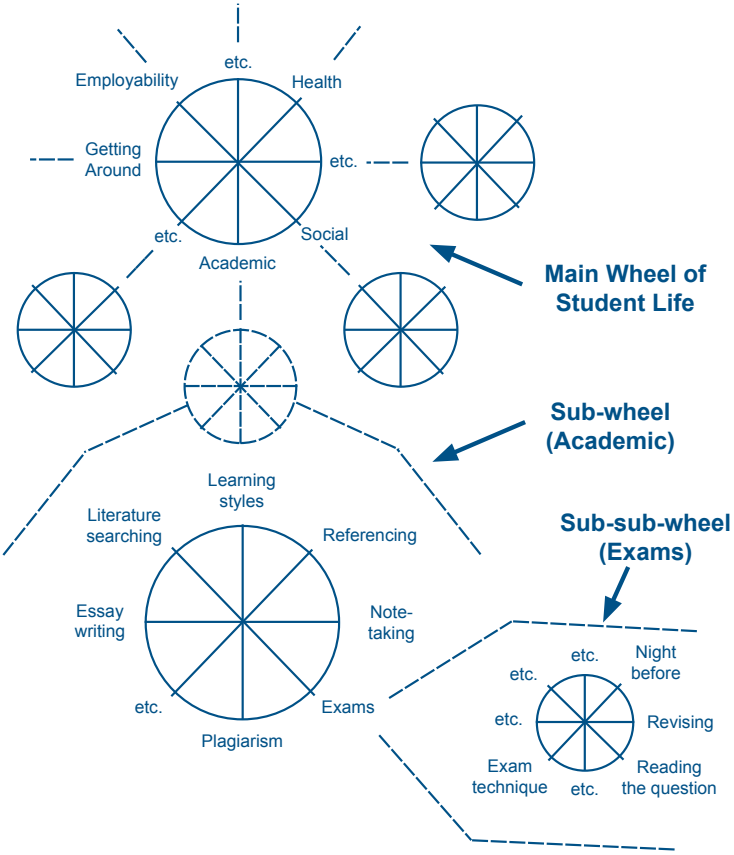

Figure 1. The WHEESL – wheels within wheels.

The Wheel of Life and Health

The … 'and Health' tag was added to the Wheel of Life to differentiate it from the many other Wheels of Life and also to acknowledge that the team designing the Wheel was representing the Faculty of Life and Health Sciences and, indeed, were all from the School of Health Sciences. The final dimensions selected by the design team included personal, social, academic, career and environment and are presented as spokes of a wheel (see Figure 2). The Wheel provides a simple illustration of how these dimensions are balanced in relation to each other. It has been designed to be reused in different teaching and learning situations to help students visualise different aspects of their university lives and how these are balanced in relationship to each other.

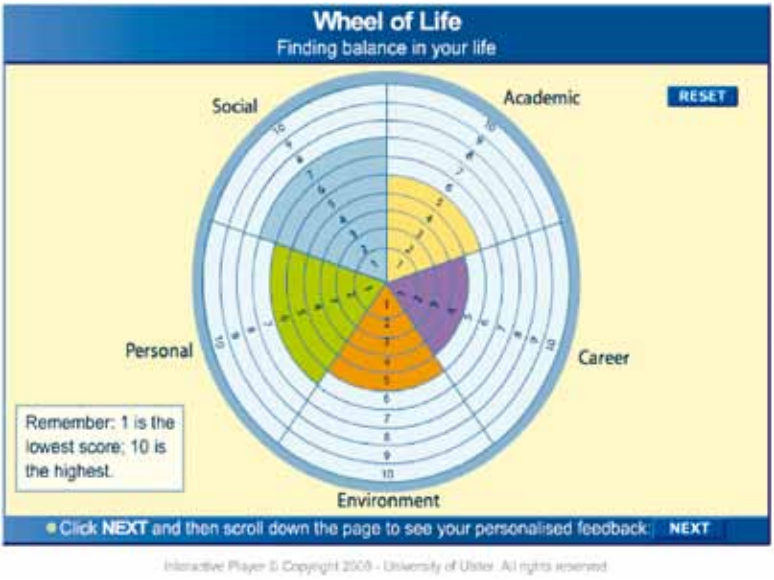

Figure 2. The Wheel of Life and Health.

The design of the Wheel was required to be flexible and capable of delivery via the University of Ulster's virtual learning environment, Blackboard Vista. Each segment starts at 1 at the centre, and goes to 10 at the outer edge. Students rate their level of satisfaction in each area with 1 representing lowest satisfaction and 10 representing highest satisfaction. This produces a visual representation of their current work/life balance and identifies

which areas might need some attention. Upon completion of all sections a 'next' button appears which, when clicked, reveals a user feedback HTML page with the user score. In addition to the user score, a feedback page is generated containing a list of current URL resources that could help address any potential lack of balance within any of the five levels of involvement.

Students can, however, also get feedback on their responses with hyperlinks to online resources that can be used to help redress the balance in specific aspects of life. They can then print a copy of this feedback, including their completed Wheel, which can, if they wish, be shared with a Personal Tutor or Studies Advisor.

Further developments

The Wheel is still very much in development and funding has been obtained from the Centre for Higher Education Practice (CHEP) to extend and customise the Wheel to measure not just perceived performance, but also perceived satisfaction for each of the skill dimensions.

Conclusion

It is anticipated that the Wheel could provide a focal point for Personal Development Planning and could be included as a tool in the PDSystem and in certain WebCT modules (such as the Self Management and Wellbeing module in the Certificate in Personal and Professional Development course and the new Reflect on Me module being developed by the Career Development Centre). This is a tool that is cross-Faculty and suited to the Studies Advice process to allow student reflection to take place and can then be used by any student, at any level, in any Faculty.

Resources

The Wheel of Life and Health can be accessed at http://cetl.ulster.ac.uk/wheeloflife/.

This includes links to related resources.

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Evaluation of Peer Assisted Learning in Mathematics (PALM) for second-year undergraduate mathematics

Joan Condell and Pratheepan Yogarajah

Introduction

Supplemental Instruction (SI), or Peer Assisted Learning (PAL), began in 1973 in the subject area of mathematics at the University of Missouri at Kansas City. It has since spread worldwide, has become internationally renowned and has improved both student retention and performance and reduced drop-out rates. SI integrates effective learning strategies within the module content and enables a clear view of module expectations. It works in the language of the discipline, challenging the barrier between year groups. The SI concept works particularly well with 'high risk' modules.

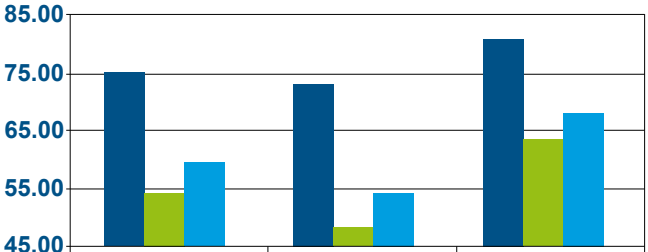
Peer Assisted Learning has been shown to provide opportunities for students to increase academic performance. The important principles of PAL or SI schemes have been identified by previous evaluative research (Martin and Arendale, 1993; Rust and Wallace, 1994; Falchikov, 2001; Capstick, 2004a; Capstick, 2004b).

These important principles include:

1. The scheme should target high risk modules or courses, not high risk students;
2. Sessions should focus on both the learning process and on content; and
3. Student mentors and leaders should be facilitators and not lecturers.

Peer Assisted Learning has been adopted by a wide diversity of academic disciplines within Higher Education (HE) including Mathematics and Engineering modules (Evans *et al*., 2001). Here, at the University of Ulster, an undergraduate second year mathematics module has been used to pilot peer assisted learning (Peer Assisted Learning in Mathematics – PALM). In particular we are interested in addressing issues such as examination performance and poor weekly attendance (which always subsequently has an effect on general module performance).

In general, in previous years students have struggled to attain good marks in examinations (Figure 1). In 2007-08 the average examination mark was 54.14% and in 2008-09 the average examination mark was 48.53% whereas in 2009-10 after the PALM pilot scheme, the average examination mark had increased to 63.58%. In 2007-08 the average coursework assessment mark was 74.69% and in 2008-09 the average coursework assessment mark was 73.33% whereas in 2009-10 after the PALM pilot scheme, the average coursework mark had increased to 80.70%.



	2007-2008	2008-2009	2009-2010
% Assessment	74.69	73.33	80.70
% Examination	54.14	48.53	63.58
% Overall	59.28	54.73	67.86

Figure 1. Average % coursework assessment, examination and overall marks for years 2007-08, 2008-09 and 2009-10 in Mathematics II. (The coursework: sessional examination weighting is 25:75.)

The next section will discuss the particular implementation of Peer Assisted Learning in Ulster (PALM). Methods of evaluation and associated results will then be discussed, followed by a summary of the pilot and conclusions.

PALM implementation

A PALM pilot has been facilitated in Ulster through senior students acting as mentors conducting weekly sessions with the cohorts. The lecturer was not present during these sessions but had debriefs with senior students (mentors) after each weekly session to obtain essential feedback. Weekly sessions involved mentors sharing their experiences with students and facilitating discussion rather than

re-teaching the subject. Students discussed and compared notes and deadlines, clarified issues, analysed, critiqued, questioned and asked for verification of ideas. These additional informal and confidential sessions did not replace lectures or seminars but provided another means of student learning within the module.

Computer Science and Engineering undergraduates, enrolled on a second-year mathematics module, participated in the Peer-Assisted Learning Mathematics (PALM) programme in the first semester of the 2009-10 academic year. The PALM programme commenced with a class of 20 students along with four group mentors (also known as peer tutors). The primary aims of PALM were to improve students' examination grades and raise students' self-confidence in their problem-solving and numerical skills. Also PALM assisted by generally providing extra support for the WebCT based weekly assignment tests. Students were provided with the opportunity to practise problem-solving questions from PALM tutorials and to discuss with their peers the difficulties encountered. PALM tutorials were created by the module coordinator which consisted of set mathematical questions designed around the weekly lecture material.

Students' perceptions of their PALM experience and their mentors' contribution were evaluated using a questionnaire. The latter revealed that second year mathematics undergraduates found PALM a highly valuable learning experience. In particular, they found the less formal, more comfortable and relaxed atmosphere of the PALM session provided them with greater freedom to ask questions and exerted less pressure on them to answer questions correctly than a more formal staff-led session. They also found the sessions increased their understanding of weekly mathematics topics covered. Statistical analysis of students' feedback and general performance shows that PALM has had a positive impact on students' examination marks.

WebCT has been used throughout many modules at Ulster to enhance the teaching experience. Alongside the use of PALM, WebCT has been used to further enhance the learning experience. Previously, weekly tests were used alone for assessment with a final examination. Students worked through tests with many challenges

and found examinations particularly difficult in the subject (Figure 1). The use of WebCT tests alongside PALM was facilitated through senior students, acting as mentors conducting weekly sessions with the cohort. Debriefs occurred weekly between the module coordinator, PALM supervisor and the mentors to obtain essential feedback. Debriefs consisted of mentors communicating weekly issues to the PALM supervisor. The PALM supervisor fed back these issues to the module coordinator. Attendance was also noted and discussed weekly.

The week's teaching finished with the weekly WebCT test to ensure the students had completely understood all of the material presented. Thus the use of WebCT alongside Peer Assisted Learning aimed to assist the delivery of the mathematics module by giving the students additional support in the form of learner support through compulsory small group learning without creating dependency. It sat alongside the weekly WebCT tests for assessment within the module.

Three final year students and a first year PhD student worked as mentors in this PALM program to support the learning of second year students. All of the students who performed the role of mentor had previously taken the mathematics module in a previous year.

Evaluation

In terms of evaluation, various methods were used to collect data during the pilot:

- Qualitative results of the PALM pilot were assessed and evaluated through extensive consultations with mentors. Discussions and debriefs occurred after each PALM session. Notes were taken and issues acted upon accordingly.
- Attendance of the student cohort was monitored and analysed by the supervisor.
- Dialogue was initiated between the student cohort and the mentors and the PALM supervisor at set times throughout the pilot to provide further direct feedback. Again, notes were taken and issues acted upon accordingly.

- Student pre-pilot and post-pilot questionnaires were created, completed and analysed to provide quantitative feedback and results.
- On completion of the module, extensive analysis was carried out on actual student coursework, examination and overall module results to evaluate the impact of PALM (Figure 1).

In order to obtain the students' more personal views regarding the PALM tutorial session, the post-PALM evaluation questionnaire began with two open-ended questions. Although students were expected to give only one response some provided more than one.

Question 1: What did you like most about the PALM session?
The rank order of students' responses is presented in Table 1.

RESPONSE
1 The less formal, comfortable and relaxed atmosphere, with the freedom to ask questions and no pressure to answer correctly
2 It helped in learning and in understanding the topics
3 One-to-one/face-to-face help
4 Being able to discuss with peers the questions and get explanations for the answer
5 Working in small groups

Table 1. What did you like most about the PALM sessions?

The top three categories accounted for 86% of the responses. The students' responses indicated that they liked the less formal, more comfortable and relaxed atmosphere of the PALM session, believing that it provided them with greater freedom to ask questions and exerted less pressure on them to answer questions correctly than a more formal staff-led session.

Question 2: What did you like least about the PALM session?
The rank order of students' responses presented in Table 2 reinforces the students' generally positive reactions towards their PALM experience, with 20% of students indicating that there was 'nothing' they disliked about the sessions.

RESPONSE	
1	Too few sample questions and maths topics covered
2	Nothing
3	Timing (time of day)
4	Lack of clarity for some answers
5	Nervousness of group mentors/leader
6	Insufficient discussion

Table 2. What did you like least about the PALM sessions?

However, a significant proportion (20%) of students disliked the timing of the PALM session, either because of 'the time of day' (because it was scheduled between 12 noon and 1.15 pm) and the scheduling at the end of the module, immediately prior to their WebCT exam. This was the first time that many of the students had encountered problem-solving questions and therefore it is perhaps not surprising that 33% felt that too few sample questions and mathematics topics were covered. In addition, some mentors expressed concern at having to explain the answers to more complex questions to peers who clearly expected their mentors to know the answer to every question they posed.

Question 3: I found the PALM session …..
All students evaluated seven aspects of the PALM tutorial sessions and their responses on a five-point semantic differential scale (5 = high, 1= low) are summarised in Table 3. The five point scale was: 5: strongly agree; 4: agree; 3: neither agree nor disagree; 2:

disagree; 1: strongly disagree. Based on the students' responses the 'Satisfying to be able to complete answers' (80%) is rated the highest and 'Valuable for WebCT test preparation', 'Confidence building in maths' and 'A good learning experience generally' received equal percentages (73.3%). The fifth and sixth aspects ('Enjoyable' and 'Intellectually challenging') received 60% and 46.6% respectively. The seventh aspect concerned the content's intellectual rating (easy/simplistic) (40%).

		% students				
5-point scale:		**5**	**4**	**3**	**2**	**1**
1	Enjoyable	**26.7**	**33.3**	**26.7**	6.7	6.7
2	Intellectually stimulating/ challenging	13.3	**33.3**	**33.3**	13.3	6.7
3	Intellectually easy/simplistic	6.7	**33.3**	**26.7**	**26.7**	6.7
4	Satisfying to be able to complete answers	**46.7**	**33.3**	13.3	0.0	6.7
5	Valuable for WebCT test preparation	**53.3**	20.0	13.3	6.7	6.7
6	Confidence building in Maths	**40.0**	**33.3**	13.3	6.7	6.7
7	A good learning experience generally	**40.0**	**33.3**	13.3	6.7	6.7

Bold figures indicate percentage values above 25%

Table 3. I found the PALM sessions.....

Question 4: By the end of the PALM session I felt …..
Scores presented in Table 4 suggest that by the end of the PALM session 60% of students felt more confident in mathematics and 73.3% of students felt more knowledgeable in mathematics in terms of their problem-solving and numerical skills (scored 4 or 5, rating scale as above for Question 3).

		% students				
5-point scale:		**5**	**4**	**3**	**2**	**1**
1	More confident in Maths	6.7	**53.3**	20.0	13.3	6.7
2	More knowledgeable in Maths	13.3	**60.0**	6.7	13.3	6.7

Bold figures indicate percentage values above 50%

Table 4. By the end of the PALM session I felt.....

Question 5: Our PALM mentors and Leader were …..
Question 5 attempted to test students' reactions to their group leaders' contributions. Over 73% of students scored 4 or 5 on all four aspects (Table 5) indicating that they valued highly the group leaders' efforts, finding them supportive, informed, considerate and encouraging.

		% students				
5-point scale:		**5**	**4**	**3**	**2**	**1**
1	Supportive	**66.7**	13.3	20.0	0.0	0.0
2	Informed	**53.3**	20.0	26.7	0.0	0.0
3	Considerate	**66.7**	13.3	20.0	0.0	0.0
4	Encouraging	**66.7**	13.3	20.0	0.0	0.0

Bold figures indicate percentage values above 50%

Table 5. Our PALM mentors and Leader were.....

Students' performance in examinations after PALM pilot
One obvious component to measure was the students' examination results for PALM attendees versus non-attendees.

	No. of students	Mean attendance	Mean Exam result
Occasional Participant (attended 1-5 sessions)	9	2.22	58.2
Regular participant (attended 6-11 sessions)	11	7.54	75.8
All students	20	5.12	68.0

Table 6. A comparison of examination results between PALM participants for the 2009-10 academic year.

Table 6 shows that mathematics exam marks increased as the number of PALM sessions attended increased. Therefore it is satisfactory to conclude that the pilot PALM program has had an impact on students' examination performance (Table 6 and Figure 1).

Student mentors' experience of PALM

This PALM pilot has assisted the delivery of the module by giving the students additional support in the form of learner support through small group learning. In turn the learning experience and personal development of the mentors has been enhanced as they have had the opportunity to train to be effective 'facilitators' – a skill which could be carried on through to employment. It has also encouraged mentors to engage with the department which may convince them to take on further study (e.g. PhD). It has given these mentors opportunities to reflect, review and re-evaluate their own studies and career path. Therefore PALM has encouraged the promotion of employability by enabling students to develop key personal and employment skills.

Summary

On completion of the PALM pilot it is necessary to evaluate the outcomes of the project against the initial requirements and objectives. The main objectives of the PALM pilot as set out initially are outlined below, alongside a brief overview of how these were met within the pilot scheme.

- Regular, ongoing student feedback to module coordinator. During the pilot the ongoing student feedback came through weekly discussions between the module coordinator and the PALM supervisor. The supervisor would attend each weekly PALM session with the mentors. Mentors would frequently feed back information and issues to the supervisor.

- Supportive environment for students (greater collaboration and learner support). Over 73% of students indicated that they valued highly the mentors' efforts, finding them supportive, informed, considerate and encouraging.

- Deeper conceptual understanding of fundamental mathematics principles. 73.3% of students felt more knowledgeable in mathematics in terms of their problem-solving and numerical skills. An improvement in examination performance was also shown (Figure 1).

- Results seemed to suggest that PALM increased individuals' confidence to pass mathematics examinations. Mathematics examination marks were shown to increase as the number of PALM sessions attended increased.

- Quality enhancement of learning experience, improvement of student study skills. 86% of students indicated that they liked the less formal, comfortable and relaxed atmosphere of the PALM session, believing that it provided them with greater freedom to ask questions and exerted less pressure on them to answer questions correctly compared with a more formal staff-led session.

- Small group teaching. The students found the more informal environment increased their confidence and encouraged greater collaboration and peer-learning between groups.

- Improved mathematics academic performance across all competencies. Students found the weekly session improved their understanding of the weekly mathematics topics.

- Analysis of difficulties arising in teaching of modules and how this relates to the overall degree curriculum. Issues have been brought to the attention of the module coordinator, particularly the fact that 20% of students disliked the timing of the PALM session, either because of 'the time of day' and its scheduling at the end of the day, immediately prior to their WebCT test. This was the first time that many of the students had encountered problem-solving questions and, therefore it is perhaps not surprising that 33% felt that too few sample questions and maths topics were covered.

- Positive impact on foundation year, first year and second year retention from diverse student range. This objective is more difficult to evaluate. Retention will be analysed in the years following this PALM pilot after the student cohort has completed other modules over the remaining years of their chosen degrees.

- Possibility of extending the project to other analytical subjects across the University. SI is integrated into the University of Ulster's Teaching and Learning Strategy and will be introduced in the coming years to a range of subjects. Currently a PASS subcommittee has been set up within the University to look at rolling out peer-learning support sessions throughout other Faculties.

Conclusion

In terms of students' views, PALM has provided an additional mechanism for weekly communication and feedback between the module coordinators and students. The weekly sessions were student-led and agenda based but were owned and controlled by the mentors. This PALM study has provided participative, proactive, content-based learner support allowing the cohort to speak to senior students about their experiences in similar technical modules. It also has given students some privacy in which to practice mathematics, make mistakes and build confidence. At a higher level, the students have found it invaluable to be able to discuss their general university, degree and module experiences with their peers.

This PALM pilot has been consistent with and informed by the School, Faculty and University's strategy to improve the teaching and learning experience of our students. Furthermore, an appreciation of mathematics is central to the developments and understanding of STEM (Science, Technology, Engineering and Mathematics) subjects and the results from this pilot scheme have shown that a significant impact has been made on students' understanding of this area. The use of peer tutoring and small groups to encourage student learning is consistent with the University's revised Teaching and Learning Strategy. PALM has provided the School of Computing and Intelligent Systems with a valuable approach to improve student pass rates in this difficult subject area, and thus improve student retention. PALM could be readily extended to other analytical subjects across the University.

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Assessment 2020:
seven propositions for assessment reform in higher education

David Boud

Assessment of students has gained a lot of attention and can be very time-consuming. But is it being done as effectively as it should? The National Student Survey results do not suggest that it is. Assessment activities have much more to contribute to enhancing student learning than is presently occurring. There have been major changes in teaching and learning in the past decade, but assessment has often lagged behind. We are now at a point when there is renewed interest in the development of assessment.

How then can assessment better contribute to student learning? This was the challenge I faced in undertaking a Senior Fellowship with the Australian Learning and Teaching Council. My task was to focus universities on the changes that were needed to ensure that assessment has a positive influence on students' continuing learning. After a considerable process of consultation with assessment experts and institutional leaders, the outcome was a document that represented an agenda for changes in assessment that would probably take ten years to be fully realised.

Assessment 2020: seven propositions for assessment reform in higher education was developed in the context of Australian universities, but those who have seen it in the UK believe that it might be equally applicable. It provides a simple statement of key features of assessment with brief justifications to prompt discussion about what changes should be made in assessment and why they should be made. It recognises that assessment is important both to help students learn and to certify them, but acknowledges that the certification agenda has perhaps become over-dominant in recent years.

It is published under a Creative Commons licence and is freely reproducible for non-profit purposes. Does it speak to your own context? Does it prompt debate with colleagues about what is important to do? I would be interested in your response.

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Assessment 2020:

seven propositions for assessment reform in higher education

Preamble

Universities face substantial change in a rapidly evolving global context. The challenges of meeting new expectations about academic standards in the next decade and beyond mean that assessment will need to be rethought and renewed.

This document provides a stimulus for those involved in the redevelopment of assessment practices. It draws on the expertise of a group of highly experienced assessment researchers, academic development practitioners and senior academic managers to identify current best thinking about the ways assessment will need to address immediate and future demands.

Underpinning principles

- Assessment is a central feature of teaching and the curriculum. It powerfully frames how students learn and what students achieve. It is one of the most significant influences on students' experience of higher education and all that they gain from it. The reason for an explicit focus on improving assessment practice is the huge impact it has on the quality of learning.

- Assessment is the making of judgements about how students' work meets appropriate standards. Teachers, markers and examiners have traditionally been charged with that responsibility. However, students themselves need to develop the capacity to make judgements about both their own work and that of others in order to become effective continuing learners and practitioners.

- Assessment plays a key role in both fostering learning and the certification of students. However, unless it first satisfies the educational purpose of ensuring students can identify high

quality work and can relate this knowledge to their own work, the likelihood that they will reach high standards themselves is much reduced.

The purposes of the propositions

The propositions have been developed to guide assessment thinking in the light of the increasing focus on standards, and to address criticisms of current practice. They set directions for change designed to enhance learning achievements for all students and improve the quality of their experience.

The propositions, however, do not stand alone. They must be considered within overall curriculum thinking alongside teaching and learning strategies and changing disciplinary content. They need to be supported by a range of development opportunities to foster the shifts in thinking and practice on the part of teaching staff and students that they imply.

The propositions are posed in a form that needs to be embraced and be taken up at different levels – specifically, by educational institutions, by programs and courses of study, and by those responsible for teaching and learning. They have implications for resources and the nature of workload; when addressed thoughtfully they may contribute to reduced costs through a better focusing of effort on those features of the curriculum and teaching that have most direct impact on learning.

ASSESSMENT HAS MOST EFFECT WHEN

1. **… assessment is used to engage students in learning that is productive.**

   i. … assessment is designed to focus students on learning

   To improve student engagement in learning, and to support better quality learning outcomes, it is necessary that assessment tasks are designed to direct student attention to what needs to be learned and to the activities that best lead to this. Effective learning can be hampered by assessment tasks that focus student attention on grades and marks or reproductive thinking.

ii. … assessment is recognised as a learning activity that requires engagement on appropriate tasks.

Assessment tasks should be significant learning activities in themselves, and not only enable judgements to be made about what has been learned. The potency of student engagement in learning is enhanced when assessment tasks require substantial involvement over time, and when they are designed in an interlinked, constructive, organised and coherent sequence.

2. … feedback is used to actively improve student learning.

i. … feedback is informative and supportive and facilitates a positive attitude to future learning.

Students benefit from clear and helpful feedback on their learning. Everyday learning activities as well as special tasks and tests provide opportunities for the provision of feedback. This places responsibility on staff to plan assessment in order to (a) develop their own skills in providing quality feedback, and (b) develop in students the skills they need to provide sound feedback to each other.

ii. … students seek and use timely feedback to improve the quality of their learning and work.

Students' own skills of judgement are developed by their utilisation of feedback, guidance provided by those already inducted into the culture and standards of the discipline, and opportunities to grow their own skills of critical appraisal. They need to be able to seek and employ feedback from a variety of sources to develop a full range of outcomes from their studies.

iii. … students regularly receive specific information, not just marks and grades, about how to improve the quality of their work.

Marks and grades provide little information to students about specific qualities of their work and do not indicate how it might be improved. While marks and grades may provide a crude tracking measure of how well students are doing, they do not help students move beyond their present standard of performance. Specific and detailed information is needed to

show students what has been done well, what has not, and how their work could be better.

3. … students and teachers become responsible partners in learning and assessment.

i. … students progressively take responsibility for assessment and feedback procesess.

The overall aims of higher education include developing students' critical thinking abilities, which include self-critique, independent judgement, and other skills for continuing learning. Personal responsibility for assessing performance and providing and responding to feedback is a desired graduate outcome. It is necessary and appropriate for university programs to foster this development throughout the curriculum.

ii. … students develop and demonstrate the ability to judge the quality of their own work and the work of others against agreed standards.

Students need confidence and competence in making informed judgements about what they produce. They need to develop the ability to evaluate the quality, completeness and/or accuracy of work with respect to appropriate standards, and have the confidence to express their judgements with conviction. This requires deliberately managed assessment processes and practice that relates to judgements required in professional practice and mature community engagement.

iii. … dialogue and interaction about assessment processes and standards are commonplace between and among staff and students.

Assessment activities and standards require disciplinary and contextual interpretation if they are to be understood, yet discussion of processes and reference points for determining standards is relatively rare. Assessment judgements are more consistent when those making them are able to reach consensus as to ways of establishing levels of performance. Student understanding of processes they can use to judge their own performance are similarly enhanced when they participate in dialogue about them with peers and teachers.

4. … students are inducted into the assessment practices and cultures of higher education.

i. … assessment practices are carefully structured in early stages of courses to ensure students make a successful transition to university study in their chosen field.

For students to become independent and self-managing learners, they need to be supported in the development and acquisition of the skills they need for learning, including those of assessment. Critical to this attainment is early engagement in manageable assessed tasks to build confidence, and the expectation that learning requires not only an investment of effort but also the taking of initiative. This contributes to alleviating anxiety around assessment information, instructions, guidance, and performance. Early assessment provides information to both students and teachers on progress and achievement, and allows for identification of students in need of additional support.

ii. … assessment practices respond to the diverse expectations and experiences of entering students.

Students come to higher education with great diversity in preparedness and understanding of what it involves. To ensure that all can engage equitably with assessment tasks, the implicit rules and expectations around what is required for success in any discipline need to be made accessible to students and opportunities provided for them to develop the academic skills they require to perform those tasks.

5. … assessment for learning is placed at the centre of subject and program design.

i. … assessment design is recognised as an integral part of curriculum planning from the earliest stages of course development.

Assessment is not an ‘add-on’ to the curriculum structure of a program. It needs to be considered from the outset of course design and intimately embedded and linked to considerations of student learning as part of the curriculum. Assessment tasks, types and means of deployment need to be fully aligned with all other aspects of the curriculum.

ii. … assessment is organized holistically across subjects and programs with complementary integrated tasks.

The development of a full range of graduate attributes requires a systematic approach to assessment that builds and enhances those attributes through tasks that are diverse, complementary to each other and embedded strategically throughout a program of study. Integrated whole-of-program curriculum design needs to incorporate assessment and feedback as well as learning outcomes and teaching and learning activities. If carried out in this way, an emphasis on feedback for learning can be the focus of teaching and learning engagement in the early curriculum, leading to capstone and integrated assessment in later years.

6. … assessment for learning is a focus for staff and institutional development.

i. … professional and scholarly approaches to assessment by academic staff are developed, deployed, recognised and rewarded by institutions.

Academics need particular support in developing expertise required for subject and program assessment responsibilities. Such support could include mentoring, dialogue with peers in informal and formal moderation activities or formal courses. However, while enhanced assessment skills are essential, their acquisition is not sufficient to ensure good assessment practice. Institutions should have explicit requirements that professional and scholarly proficiency in assessment is necessary for satisfactory teaching performance. Further, leadership and exemplary performance in assessment matters should be recognised for promotion, awards and grants.

ii. … assessment practices and the curriculum should be reviewed in the light of graduate and employer perceptions of the preparedness of graduates.

The impact of courses on student learning, and the role of assessment in them, can only be fully evaluated following graduation. Common post-graduation measures (e.g. the Course Experience Questionnaire, the Graduate Destinations Survey) presently provide insufficiently detailed information for the improvement of programs. In particular, they do not

enable assessment and feedback processes to be sufficiently monitored. Systematic study of the impact of such experiences on graduates (at, say, one and five years from graduation) and employers' perceptions of such preparation and standards are needed to ensure that courses are effective in the longer term.

iii. … assessment of student achievements is judged against consistent national and international standards that are subject to continuing dialogue, review and justification within disciplinary and professional communities.

The quality of awards in higher education will be increasingly scrutinised nationally and internationally. Assessment practice needs to provide convincing evidence of students' accomplishments that can be judged against external reference points. Disciplinary and professional communities (both within and beyond the academy) are the focus for ongoing collaboration and dialogue to determine, review and moderate academic achievement standards. Such collaboration and dialogue requires clarity of expectations and persuasive evidence of learning outcomes.

7. … assessment provides inclusive and trustworthy representation of student achievement.

i. … interim assessment results used for feedback on learning and progress do not play a significant role in determining students' final grades.

For purposes of certification, care must be taken to avoid the formal use of early grades that do not represent the outcomes reached by course or program completion. Entry-level knowledge, learning rates and final achievement levels differ. Although learning itself is cumulative, progressively adding marks throughout the learning period towards the final grade can distort representation of end-of-study achievement. What is important is using interim outcomes to improve learning.

ii. … evidence of overall achievement to determine final grades is based on assessment of integrated learning.

Many separate low-value pieces of assessment can fragment learning without providing evidence of how students' knowledge

and skills from a unit of study are interrelated. This is often compounded across subjects, leading students to experience knowledge as disconnected elements. Strong evidence of achievement of the totality of outcomes can be provided by larger-scale tasks that require students to demonstrate coherent integrated learning, not isolated or atomistic performance.

iii. … certification accurately and richly portrays graduates' and students' achievements to inform future careers and learning.

An academic transcript that lists subject titles and grades provides limited information to students, employers or educational institutions. Increased scope and sophistication of the reporting of achievement is needed to communicate outcomes well. Two areas for improvement are: veracity, in grades that are fully and robustly aligned with learning outcomes and standards; and, richness, in the documentation of student accomplishments to convey information about what students can and cannot do.

Suggestions for use

These propositions can be used to focus debate and action on those features of assessment that have the greatest impact on learning and the quality of courses.

They might be most productively used by:

- Planning teams and program directors in new course design and course review and renewal;
- Teaching and learning committees and academic boards, institutionally and locally;
- Groups of Associate Deans and Directors of Teaching and Learning within and across Faculties;
- Those running courses and workshops for academic staff on assessment, and particularly within Graduate Certificates in Teaching and Learning in Higher Education;
- Those running leadership programs to ensure that leaders at all levels have a strong appreciation of assessment issues and directions;

- Those with academic development roles who consult with staff and course teams; and

- Those guiding staff-student discussions about the improvement of courses.

The challenge is to consider how these might be best pursued within existing cost constraints. This must necessarily involve deciding which assessment tasks should be discontinued in order to provide space for more worthwhile initiatives.

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