Case study 1: Developing Graduate Attributes – demonstrating "sustained effectiveness in relation to teaching and learning" – February 2015 [1]

Computing science students tend to focus on technology: what it can do, and what they can make it do. As a strong proponent of the need to develop transferrable skills that will prepare students for the world beyond graduation, I include learning activities in my teaching that will help students develop a range of communication, critical analysis, collaboration and reflective skills that I know will be of benefit to them through their longer-term learning journey (v). Encouraging transferrable skills that are not clearly associated with computing science content is not always easy with a group of technology-focused students.

Peer review in practice

Peer review develops critical analysis and reflective skills (Falchikov, 1995). Importantly, when students get a range of different feedback from different peers, it encourages students to reflect on what is and what is not important, and to recognize that it is unreasonable to believe that there is only one single 'ground truth' (that held by the instructor).

I introduced peer review in my third-year Human-Computer Interaction (HCI) class in 1999, whereby students assessed each other's' interface design according to a given list of criteria. The aim of this exercise was to enable students to see that there could be more than one correct solution to a design problem, and, through looking at solutions different to their own, to encourage them to be both critical of others' work, as well as reflective and critical of their own (K3). This was a successful exercise that I repeated several times. Peer review was a novel assessment method at that time, and this work was published in an educational journal (Purchase, 2000).

I have continued to use peer review in several of my classes. I introduced it into our final-year Professional Skills course (where its use has been commended by the British Computer Society in their accreditation visits (iii)) and use it in my MSc HCI course (where it includes a "response to reviewers' comments" phase).

Over the years that I have used peer review (vi), I have learned that:

- Students often feel uncomfortable giving feedback on peers' work since they do not believe that their opinion is useful; giving clear guidance helps them, as does integrating regular peer review into the curricula so that it is used so frequently that students come to realize the worth of their own opinion.
- The quality of the feedback given by students varies a great deal; if the quality of the feedback is formatively assessed in some way, it tends to be of better quality.
- When given a chance to revise their peer reviewed work, students do take their peers' opinions seriously (K3). They may have to decide between contradictory views, or filter out spurious comments, but they do not dismiss the feedback out of hand.

[1] Note: References in brackets here and in the case studies refer to the dimensions of the UKPS framework (A,K,V), and the associated descriptors for Senior Fellow of the Higher Education Academy (i,ii..vii).

Technology supported peer review: the Aropä system

I am co-creator of the online Aropä peer review system (www.dcs.gla.ac.uk/~hcp/aropa) (K4); my colleague Dr John Hamer and I run this project on a voluntary basis, providing online peer review support to academic colleagues across the world (K3, K4, V3).

Aropä allows students to submit work online, and then to review other students' work with reference to a marking rubric created by the class instructor.

After been involved with the project while at Auckland University on sabbatical in 2009, Dr Hamer and I were awarded a grant from the HEA Subject Centre for Information and Computer Sciences for a project to deploy of the Aropä at the University of Glasgow and adapt it for multi-institutional use. It has since become well-established at Glasgow (with regular users in Classics, Biology, Social and Political Science, Veterinary Science, Academic Development, Computing Science, Finance, and Geology). At least two schools (Classics and Veterinary Science) have included Aropä use into their design of new curricula.

Aropä also has international reputation and use. Aside from the regular users at The University of Auckland (Engineering, Law, Clinical education, Anthropology, Pharmacy, Computer Science, Biology), it has recently been used at other universities: Virginia Tech, Texas, Cyberjaya (Malaysia), Robert Gordon, Strathclyde, Washington and Lee. We get a new, unsolicited request for access approximately every two months. I have held formal Aropä training sessions for academic staff at Glasgow University, Robert Gordon University and Sheffield University, and engage in regular informal support for existing users.

I am involved in all aspects of designing the system and its interface, with training users, and in providing user support and documentation. I also advise instructors on appropriate use of the system with respect to the learning outcomes of the course (vii), including discussing the skills that they wish their students to develop, and identifying, designing and supervising modifications to the system to as to include new pedagogical approaches (A4). For example, a recent modification will allow a lecturer in Classics to be able to mark the students' reviews, and allow authors to see how the reviews on their work were marked.

In addition to supporting the practical use of Aropä, we have performed large-scale analysis of student reviews, and published research articles presenting the results of these analyses (Hamer, Purchase et al, 2009 & 2014).

As of February 2015, Dr Hamer and I have been invited to be part of a Horizon 2020 EU funding proposal on "Peer assessment for e-learning environments" together with a consortium of four universities and three software organizations. The particular expertise that the lead investigators have asked us to provide is our practical experience in running the Aropä system (including our extensive knowledge, built up over several years, of what does and does not work in practice, and staff and student opinions) as well as our system design and development skills. Few others could lay claim to the extent of our knowledge of online peer-assessment in practice.

Reflective practice

In my second-year Information Management class in 2006, inspired by educational initiatives in the area of Personal Development Planning (Moon, 2001; Goldfinch and Hughes, 2007), I introduced the students to the concept of a 'personal reflective logbook': a small notebook

that they were encouraged to carry around with them, and make reflective notes in at any time. Interspersed in the lectures were short reflective exercises (e.g. "How much (as a percentage) of this relational algebra material do you understand?"; "Write down your countdown timetable towards submitting your assignment on time"; "What skills are you good at?"). The idea was to encourage students to think about themselves and their role as a learner, and through this, to encourage the development of planning, reflection and self-assessment skills (A4, K3).

This exercise was not as successful as I would have liked: a significant minority of students liked the chance to reflect and think about something different during the classes; a similar proportion of students did not like it (and wanted to get on with the 'real learning'), and the remainder simply did not see the point. However, one student told me several years later that the idea of this logbook positively changed the way he conducts his life: he is now never without his personal logbook, and relies on it to keep him on track with his personal and professional goals.

On reflection, I think that perhaps the second-year students (mostly aged around 19 or 20) were not mature enough to recognize the value of this reflection and recording of ideas, and could not see its relevance or relationship to one taught course. In addition, the knowledge that their final assessment for the course would be based on the domain-specific content of the course meant that anything else that they were asked to do appeared to them to be superfluous. I find that Honours students whose projects I supervise are more willing to adopt a reflective approach, and use a logbook regularly.

Transition from undergraduate to postgraduate: reading skills

As part of the re-development of the Masters programmes (see case study 2), I initiated a new Masters-level course called "General Readings in Computing Science", whereby students were required to read and summarise at least two seminal papers in Computing Science a week (A1, A2, K2). The aim of the course was to develop students' ability to read papers effectively (something that undergraduate students typically do not do), and express the core message of a paper succinctly.

This course was generally well-received by students who welcomed an opportunity to explore the breadth of non-technical Computing Science: "*The course made me think and express my opinion on many subjects that I would otherwise have ignored. We are usually taught how to read papers – this course has taught me how to understand them.*" [student feedback comment].

The qualitative nature of the student submissions in this new course, the other new Research Readings course, and the redeveloped Professional Skills course represented a departure for the academics in the School of Computing Science, who are used to marking quantitative assessments. These courses were developed at the same time that the university's new assessment code was released, requiring criteria-based assessment against descriptors. I produced a written guide to this new code for fellow academics, gave a seminar on its use, and devised appropriate marking grids for marking essays and projects in computing science (vii). Distributing these marking grids to students in advance is now one of my assessment policies – it encourages students to reflect on what is important for their learning through their assessment preparation.

Contributing student pedagogies

A contributing student pedagogy is one where students create artefacts that contribute to other students' learning (Hamer, Purchase et al, 2008). While the process of artefact creation is as worthwhile to the students as when creating any other item of assessment, their learning is enhanced when engaging with artefacts produced by other students. Not only does this practice contribute to the development of a community of learners (Wenger, 1998), the fact that the instructor no longer has complete control over the learning materials means that the students' role changes from passive observation to active contribution, developing negotiation and reflection skills in particular.

I was a member of the ITiCSE working group that defined "Contributing student pedagogies" Hamer, Purchase et al, 2008) and the later working group that reviewed tools that support such pedagogies (Hamer, Purchase et al, 2011).

I was part of the research team that presented and conducted the early evaluations of the Peerwise system – a contributing student online system produced by Dr Paul Denny that enables students to write multiple-choice questions for their fellow students to attempt and comment on (Denny, Purchase et al. 2008a, 2008b, & 2009; Purchase, Denny et al. 2010).

In my classes, I have used CSP in several ways (K2), including:

- In the Research Readings classes, the students themselves summarise, critique and present a research paper to the rest of the class in an oral presentation: while the other students would have read the paper, the summary and critique are provided by the presenting students.

- In the Professional Skills and Issues classes, groups of students identify a social, legal or ethical issue that affects IT in some way, and prepare a poster for a poster session attended by all students. In different groups, they also identify an IT professional issue occurring in the workplace and create a short video to demonstrate it. All students attend the 'video showcase' when all videos are shown. The variety of possible issues that can be chosen in both cases by the students means that they all learn a range of topics from their peers' work.

- In my undergraduate HCI class, I ask students to create a powerpoint presentation critiquing a design of an everyday object – these are made available to the whole class, who vote on their favourites: since the range of objects chosen, and the extent of criteria used for critique is vast, students learn to reflect on and analyse their surrounding environment in a critical manner.

- Frequently in my classes, I will pose a problem, give the students some time to work on it, and then ask three or four students to write their solutions on an overhead slide. We then have a whole-class discussion on these solutions, comparing them, critiquing them, identifying errors and good practice. While some students are sometimes hesitant about doing this, they appreciate the collaborative learning environment that results from these class discussions.

Encouraging a student to share their work with other students demonstrates that I value their work enough to believe that other students can learn from it – this is a positive outcome for the contributor. Students seeing the range of work created by their peers gives them an important sense of how their work relates to other students' – while some students might have a negative response when seeing work that is better than their own, this develops important reflective abilities: they are forced to both identify why they think someone's work might be better than theirs, and how they need to improve their own efforts.

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