CBAF: Meeting Challenges in HE Today

Widening participation in higher education, at both undergraduate and taught postgraduate levels, means that students face an increasingly steep learning curve during their study programmes. Innovations in teaching, such as problem-based learning (PBL), may enhance student skills in areas addressed inadequately by traditional pedagogy, but make substantial demands on student time. Likewise, students of practice-based subjects must demonstrate high levels of professional competency; this may detract from their performance in other areas. Finally, entry to Master's courses by students with professional qualifications or work-based experience means that 'graduate skills' cannot be assumed. Hence, for **students** the need has become acute for unrestricted access to targeted, effective, academic guidance by which they can judge their progress. For **staff**, changes to the HE sector involve increased participation, (targeting 50% of those aged 18-30 by 2010[1] which HEFCE estimates as additional 350,000 full-time students); progress towards fair access; and reduction in non-completion. This presents a formidable challenge: how do we maintain academic standards, by valid and reliable assessments, whilst providing an environment that will promote a deeper approach to learning? We propose that CBAF can *assist* us in meeting these challenges.

The Requirement for Effective Assessment and Feedback

QAA Subject Overviews for the areas covered by this project identify assessment, and associated feedback, as an area of weakness in TLA. For example, in ORGANISMAL BIOSCIENCES,

> *'…weaknesses … are predominantly in the arrangements for the assessment of the students' attainments…. special attention needs to be given to improving … formative and summative assessment of student work.'*

In NURSING, explicit links to intended learning outcomes,

> *'..the detail, timing and quality of student feedback of assessments and the link between learning outcomes and assessments could be improved.'*

In contrast, in DENTISTRY, assessment practices were identified as strength of the provision:

> *'Assessment … includes a variety of methods…'* with *'…examples of innovative assessment'*

and in CIVIL ENGINEERING, assessment and feedback was a concern:

[1] DfES (2001). Education and Skills: Delivering results, a strategy to 2006, DfES Publications.

'… assessment practices frequently include scope for improvement… Staff comments on student work are not always informative and helpful'

Thus, the Subject Overviews confirm that the aims of this project are related directly to local and national priorities.

Assessment and Learning

There is much evidence to show that assessment motivates student learning[2]. However, students exhibit complex learning behaviours[3]: they may adopt a surface approach to meet the requirements of the task; a deep approach to maximize understanding; or an achieving approach, where a high grade is the sole goal [4]. Generally, there has been concern to promote a deep approach to learning and methods have been suggested to achieve this[5]. There is also evidence that the ***form*** of the assessment can influence a student's approach to learning. Thus a difficulty for assessment construction is that a student's learning-related characteristics can be determined by their perception of the assessment task and the approach to learning, which may directly affect a learning outcome (e.g. an assessment) may, or may not, reflect their learning predispositions[6,7]. Paper-based objective tests, such as MCQ's, may present a particular difficulty. Students preparing for these used a surface strategy and perceived them as assessing knowledge. But when preparing essays these students employed deep strategies and perceived essays as assessing higher cognitive skills[8]. Use of MCQ's, can increase surface approaches, such that in medical education, for example, there may be little link between clinical performance and examination results[9,10]. Assessment itself may discourage a deep approach, and an emphasis on grades is not conducive to deep learning[11]. As academics who assess only knowledge reproduction also have the same attitude to teaching[12], the form of the assessment must be carefully constructed to promote student

[2] Brown, G., Bull, J., et al. (1997). Assessing student learning in higher education. London, Routledge.
[3] Miller, A. H., Imrie, B. W., et al. (1998). Student assessment in higher education: A handbook for assessing performance. London, Kogan Page.
[4] Biggs, J. B. (1993). What do inventories of students' learning processes really measure? A theoretical review and clarification. British Journal of Educational Psychology 63: 3-19.
[5] Brown, G., Bull, J., et al. (1997). Assessing student learning in higher education. London, Routledge.
[6] Biggs, J. B. (1993). What do inventories of students' learning processes really measure? A theoretical review and clarification. British Journal of Educational Psychology 63: 3-19.
[7] Beishuizen, J. J. and Stoutjesdijk, E. T. (1999). Study strategies in a computer assisted study environment. Learning and Instruction 9(3): 281-301.
[8] Scouller, K. (1998). The influence of assessment method on students' learning approaches: Multiple choice question examination versus assignment essay. Higher Education 35(4): 453-472.
[9] Stiernborg, M. and Bandaranayake, R. C. (1996). Medical students' approaches to studying. Medical Teacher 18(3): 229-236.
[10] McManus, I. C., Richards, P., et al. (1998). Clinical experience, performance in final examinations, and learning style in medical students: prospective study. British Medical Journal 316: 345-350.
[11] Karabenick, S. A. and Collins-Eaglin, J. (1997). Relation of perceived instructional goals and incentives to college students' use of learning strategies. Journal of Experimental Education 65(4): 331-341.
[12] Samuelowicz, K. and Bain, J. D. (2002). Identifying academics' orientations to assessment practice. Higher Education 43(2): 173-201.

learning. If such care *is* taken, the evidence is compelling that assessment can be used strategically to improve the ways students learn[13].

Also, conflict may arise between the pedagogy and the form of assessment. PBL has been credited with encouraging a deep approach to learning[14], and students undertaking PBL performed better in objective performance-based tests [15]. However, it is essential that the assessment used with PBL does not negate its benefits. In one PBL-based programme, students who regularly monitored their own knowledge with CBAFs performed significantly better in summative assessments[16].

The Strengths of CBAF

When surveyed, students typically report that they enjoy using computer-based assessments, appreciate the open access, perceive it as fair, and find the feedback helpful[17]. Indeed, computer-based assessment has been found to increase student examination scores when compared to traditional methods, as well promoting positive student attitudes towards its use[18]. Timely and targeted feedback, it is generally agreed, is essential to promote student learning and many studies report favourable responses to the immediate feedback from computer-based assessments, as it allows students to assess their progress and prioritise their learning activities[19]. Feedback simply providing the correct answer would not enhance learning— students are not motivated solely by a grade, but desire feedback that assists *deep learning* and which helps them to improve[20]. Feedback thus can act as a key component when using assessment strategically to change student learning behaviour[21].

CBAF permits **students** to assess their progress against defined learning outcomes through open access self-tests. These tests can provide timely focused feedback that encourages reflection, enhances learning, and promotes independent study. These outcomes support student progression. CBAF's invite the **teacher** to examine closely *what* is being assessed, *how* to structure the assessments, and how to use assessment *effectively* to enhance student learning. CBAFs also may

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[13] Gibbs, G. (1999). Using assessment strategically to change the way students learn. Assessment matters in Higher Education: choosing and using diverse approaches. S. Brown and A. Glasner. Buckingham, Open University Press: 41-53.
[14] Jervis, L. and Morris, P. (1996). Environmental Biochemistry - A Problem-based Approach. Biochemical Education 24(4): 215-221.
[15] Schwartz, R. W., Burgett, J. E., et al. (1997). Problem-Based Learning and Performance-Based Testing: Effective Alternatives for Undergraduate Surgical Education and Assessment of Student Performance. Medical Teacher, 19(1): 19-23.
[16] Driessen, E. and van der Vleuten, C. P. M. (2000). Matching Student Assessment to Problem-based Learning: Lessons from Experience in a Law Faculty. Studies in Continuing Education, 22(2): 235-248.
[17] Croft, A. C., Danson, M., *et al.* (2001). Experiences of using computer assisted assessment in engineering mathematics. *Computers & Education* **37**(1): 53-66.
[18] Kulik, J. J. and Kulik, C. C. (1991). Effectiveness of computer-based instruction: an updated analysis. *Computers in Human Behaviour* **7**: 75-95.
[19] Hogg, J. (1997). " Geography Students Assess Their Learning Using Computer-Marked Tests." *Journal of Geography in Higher Education*, **21**(1): 121-126.
[20] Higgins, R., Hartley, P., *et al.* (2002). The conscientious consumer: reconsidering the role of assessment feedback in student learning. *Studies in Higher Education* **27**(1): 53-64.
[21] Gibbs, G. (1999). Using assessment strategically to change the way students learn. *Assessment matters in Higher Education: choosing and using diverse approaches*. S. Brown and A. Glasner. Buckingham, Open University Press**:** 41-53.

be used as effective diagnostic tools, which enable the teacher to identify and address student deficits, so improving the staff effectiveness in teaching. In addition, summative CBA's can be better discriminators of student performance than subjective tests.

This project will exploit these characteristics of CBAF by producing cross-disciplinary, *generic* guidelines for assessment construction.

Overcoming Barriers to Embedding CBAFs in Teaching

The sophistication of CBAF tools today permit computer-based testing of a range of cognitive skills. The primary assessment tool used here, TRIADS, allows assessment of advanced cognitive skills and delivery of immediate, focused feedback. Assessment authoring and delivery is straightforward, requiring little technological expertise. Some other software tools e.g. Question*mark* Perception, can perform similarly if assessments are authored appropriately. However, a significant barrier to CBAF usage remains: the ability of the academic to ***author*** appropriate questions and to ***combine*** these in assessments in a way that enhances student learning. As Brown *et al*. [22] aptly point out,

> *'…lack of confidence in technology may be a cloak for lack of expertise in assessment and for the reluctance to give up familiar approaches. Investing more time in design and less time in marking is, for many, a profound change in working practice'.*

There are many practical reasons for adopting targeted computer-based assessments; some—including mass-testing, immediate feedback, automatic marking and analysis—are difficult to achieve by other methods[23]. However, there is a compelling pedagogical reason for utilizing computer-based assessments: the structured nature of question types provided by software tools focuses the author on the objectives of each item. This facilitates the construction of assessments containing a diversity of question types, addressing intended learning outcomes, cognitive skills and validity[24]. One prime characteristic of computer-based assessments — instantaneous feedback — can itself promote deep learning[25], so that CBAF (rather than summative tests alone) with questions addressing differing cognitive levels, can be used to enhance the quality of student learning. Whilst essay questions have traditionally been used to test deep learning, carefully constructed objective tests certainly can do this[26]. Also, questions for formative assessments need

[22] Brown, G., Bull, J.*, et al.* (1997). *Assessing student learning in higher education*. London, Routledge.
[23] Ibid.
[24] Huff, K. L. and Sireci, S. G. (2001). Validity issues in computer-based testing. *Educational measurement: Issues and practice* **20**(3): 16-25.
[25] Higgins, R., Hartley, P.*, et al.* (2002). The conscientious consumer: reconsidering the role of assessment feedback in student learning. *Studies in Higher Education* **27**(1): 53-64.
[26] Cox, K. and Clark, D. (1998). The use of formative quizzes for deep learning. *Computers & Education* **30**(3-4): 157-167.

not be so rigorously constructed, which eases authoring and allows student input to their content[27].

Here, we shall base our assessments upon a simplified cognitive taxonomy, Imrie's RECAP model[28]. Assessments will be constructed from questions covering Recall, Comprehension, Application and Problem-solving in a mix appropriate to the learning outcomes. Amalgamation of higher cognitive levels (i.e. analysis, synthesis and evaluation) into a single category, Problem-solving, simplifies the design of questions targeted to these aspects of Bloom's taxonomy.

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For more information about the OLAAF project and its products, see http://www.bbk.ac.uk/olaaf/

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[27] Bull, J. and Stephens, D. (1999). The use of question mark software for formative and summative assessment in two universities. *Innovations in Education and Training International* **36**(2): 128-136.
[28] Imrie, B. W. (1995). Assessment for learning and taxonomies. *Assessment & Evaluation in Higher Education* **20**(2): 175-189.