The Assessment of EPC Output Standards

A report on a survey of EPC Members, Spring 2001

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The Report

The development of output standards, or of other authentic descriptions of the achievements that distinguish new graduate engineers, signals the need for trenchant thinking about assessment systems and purposes. Without it the output standards will not work as intended. Any attempts to press on regardless may cause existing assessment systems, which this report shows to be under stress, to fail.

This paper reports the findings of a survey of EPC members which was designed to get a better understanding of what works well in present assessment practices and what is proving problematic. The assumption is that good change strategies come from a sound appreciation of existing practices and why they are as they are. Recommendations are made on the basis of an analysis of the responses. They are summarised overleaf and amplified on page 17.

It appears that a lot needs to be done to ease the tension between the need for those new approaches implied by the output standards (and QAA benchmark statements) and assessment practices as they are now.

Summary of Recommendations

1. This survey is likely to under represent the problems associated with trying to change embedded assessment practices.
2. EPC is urged to provide more exemplar materials.
3. A good dissemination device is to publish worked out assessment tasks that illustrate ways of making judgements about achievement in terms of the output standards.
4. Existing assessment practices need to be streamlined to accommodate the new demands of output standards assessment. It may be possible to save time by reducing the summative assessment load and compensating through less expensive formative assessment.
5. Departments might be encouraged to do assessment audits before beginning to change assessment practices to align them better with the output standards.
6. Departments are advised to have programme level assessment plans.
7. There is a need for assessment training.
8. The EPC might wish to explore the possibility of seeking funding for a national pilot programme in head of department leadership education.
9. The more the work of EPC, QAA, the LTSN Engineering Subject Centre (Loughborough), and other interested parties can be co-ordinated, the better.

Assessment implications of output standards

EPC's output standards are remarkable for the care taken to make sure that they are a valid representation of engineers' complex professional work. Some professors responding to the survey described in the body of this report also said that these are demanding standards, perhaps, said one or two of them, too demanding. However, that combination of ambition and authenticity makes it hard, costly or impossible to assess all of the output standards in the ways that have been traditional in a number of university subjects and areas. In the words of

Informant #48, much assessment difficulty comes from, '…the highly integrated nature of the material, plus the huge spectrum of … different engineering specialisms'.

It was argued in an earlier paper for the EPC's Assessment Working Group that these output standards imply an approach to assessment with the following characteristics:

i)   A systemic, programme wide approach to assessment.

ii) Summative, grade-bearing assessment of those outcomes that can be reliably and affordably assessed.

iii) Greater use of formative assessment, especially for output standards that elude summative assessment.

iv) The orchestrated use of a range of assessment methods.

v)   Care for progression in learning and assessment such that, for example, the later stages of programmes set authentic and substantial assessment tasks that show how students respond to complex, real-world problems involving the application of learning from different courses to somewhat-novel settings.

vi) Support for students in making their own claims to achievement, claims that will be informed by the summative and formative assessment processes.

vii) Transcripts attesting to the process standards applying to a degree programme – they would describe, for example, the learning opportunities presented to students, the complexity and novelty of tasks set, and the amount of help or structure available to students in their final year.

These are challenging implications. This survey of EPC members relates them to current assessment practices in engineering.

Findings from a survey of EPC members, Spring 2001.

In March 2001 EPC members were invited by the Assessment Working Group (AWG) to respond either to

four open-ended questions or to nine. The first four questions asked about present practices and difficulties that might arise if output standards had to be assessed. The last five followed up some assessment implications of the adoption of output standards. The AWG was acutely aware that the response rate for surveys is low and continues to decline, so it resolved to use a simple instrument that could be quickly completed rather than a more comprehensive one that people would ignore. The questionnaire is at Appendix 1. Forty-eight usable returns were analysed.

The enquiry methods were such that it is most appropriate to report the data in ordinal form. There are similar reasons why statistical routines have not been used. What follows can be read as a robust indication of prominent aspects of current practice in engineering in universities that are mainly in England. Some informants said they spoke for teams or departments and others spoke only for themselves but a large minority did not say whose views they reported. This lack information undermines any attempt to give more weight to the views of teams than to the views of individuals.

A corollary of these methodological points is that although the data have been carefully analysed, the trustworthiness of the findings is not warranted by the enquiry methods. The test of this study is whether colleagues find what is reported here recognisable and plausible: in that sense the report's audience validates the enquiry.

1. Reservations about the EPC Output Standards project.

Some informants said that trying to assess students against the EPC's (or any other) output standards is only sensible where it is believed that the output standards themselves are valuable, informative, useful and 'assessable'. One trenchant comment was that EPC standards are:

…without exception vague bullshit, [so] how can they be used? The EPC version, esp[ecially], had examples which

clearly demonstrated an enormous real divergence of standards. This taxonomy business is the height of fashion, but that doesn't make it a science. Why did EPC bother coming up with a different taxonomy from everyone else? - since they are all practically ineffectual (as demonstrated by EPC) why not agree on just one? To be usable the taxonomies need to be much more explicit about the details of the skills needed and the corresponding outcomes, e.g. in terms of the extent of calculation and use of science expected in arriving at a result (Informant #5)

Others were concerned that the standards are over-ambitious, describing achievements of the best, rather than of modal or threshold engineering graduates:

The greatest danger is that courses would be shaped to fit the taxonomy rather than the educational intentions of the course providers. I believe that such processes encourage dishonesty in claiming that students have achieved ludicrously grand standards. What might be an aspiration for the best students in their best subjects is presented as the actual achievement of all students in all subjects. No head of department will admit that their students achieve anything less than what is claimed as learning outcomes by a rival department, so all collude in the pretence. The outcomes as presented falsely present the graduate as more knowledgeable in vastly greater breadth than is reasonable, and give prominence to matters that should be only by the way. (Informant #34).

I do think, however, that some of the benchmark statements (e.g. some of those in E1.2.6 and E1.2.7) are unrealistic expectations of even the most able student. (Informant #38).

A third small group was concerned that the standards were not yet a suitable basis for good assessment purposes:

Learning based outcomes are not currently in all of our (staff) everyday vocabulary, nor are we necessarily well equipped to evolve/define them to date … The measuring

of achievement of very specific learning outcomes requires perhaps a long rethink and certainly a revisit of all programme and module related information, and a good understanding of the programme deliverables. (Informant #43)

A fourth set of reservations centred on the number of players in the field - on competing descriptions of what was to count as graduate level competence in engineering.

EPC and the engineering Council should accept that with QAA Benchmarking now a fait accompli, we should reduce the admin burden on departments by using the information generated during subject reviews for accreditation purposes. If the EPC is not happy with the detailed implementation of QAA procedures than it should work to modify those to its satisfaction. (Informant #40).

Let me stress that these fundamental reservations about the whole Output Standards enterprise were expressed by a minority. I begin this report with them, though, because it is clear that any attempts to change assessment practices that are based on the EPC's output standards will be vulnerable to objection on the grounds that the very enterprise itself is defective in some way. One difficulty compounds the other. Where people are not enrolled into the EPC's output standards they are liable deny the value of work on the assessment of such standards. This hinders attempts to develop good assessment practices based on the standards, practices that could help to persuade doubters of the usefulness of the output standards themselves.

2. Current assessment practices in engineering

Output standards have a better chance of being adopted if they imply assessment practices that are congenial to those already in currency. Where there is a substantial gap between present practice and what is implied by the output standards, then difficulties - even severe difficulties - can be anticipated.

Responses to survey question 1, which asked about the

five main assessment practices currently in use provide some reassurance in that they show a mix of assessment methods and practices. The way that the question was asked guarantees that answers under represent the range of methods in use because informants are invited to name the five most important, not all the methods in use. Key findings are:

i)   All informants use examinations, emphasising their importance in providing secure judgements of individual attainments. (There are lively concerns about plagiarism in coursework.)

ii)   Time constrained tests, often done in lectures, were reported by almost half the informants.

iii) Virtually all informants used projects work and reports of project work to assess students.

iv)   Three quarters referred to presentations

v)   Just over half of the informants mentioned using laboratory reports for assessment purposes.

vi)   Design studies were specifically identified as a powerful assessment methods by about a quarter of respondents.

vii) About a quarter praised viva voce examinations or other oral investigations as searching appraisals of understanding and good safeguards against plagiarism.

viii) A similar number valued assessment by poster presentation.

One conclusion is that a good range of assessment methods is in use. In the words of two EPC members,

The methods employed currently are perfectly adequate. They provide for a variety of assessments and allow both formative and summative feedback. The methods have evolved over a number of years and are still being enhanced and improved. I would expect to be looking continually at what we do and how we do it and developing new strategy's as we move along. (Informant #37).

It is always easy to do better with more resources. The

current system is very good given the current constraints. (Informant #48).

Nevertheless, it is worth setting this picture of diversity alongside the list of 55 assessment methods in Appendix 2 and concluding that a more extensive range of assessment techniques is available. Many of them have at least face validity as ways of assessing some of the EPC's output standards.

However, a simple survey such as this cannot answer some questions that might qualify the conclusion that a good range of practices is in place. For example:

i) We do not know about the quality of tests and examinations. Some responses made a point of saying that it is important to give students fresh challenges and authentic problems to work on. That is exactly the approach implied by the output standards. However, there is strong anecdotal evidence that exams and tests can be formulaic and concentrate on repetition of information, not on authentic thinking as engineers-in-the-making.

ii) It is not clear how much scaffolding students have in their assessments. In other words, nothing is known about the process standards related to the assessments, so there is no way of knowing whether an assessment task is easy (because plenty of 'scaffolding' is provided for the student) or demanding (because the task calls for an individual, unsupported performance).

iii) Many informants referred to group assessment activities but the survey provides no information about the ratio of group to individual assessment activities, nor about whether skill at working in groups is itself assessed. This lack of information is significant because the output standards attach importance to the development of skill as a group worker.

iv)   The questionnaire did not ask about the relationship of formative to summative assessment and the balance between them.

A modest conclusion would be that a good range of assessment practices is to be found in the engineering community, which indicates some capacity to respond to the assessment demands of the output standards. This conclusion is strengthened by responses to question 5, which asked whether these assessment approaches seem to satisfy employers. Two informants said this was not a good question on the grounds that higher education is not intended just to satisfy employers. That said, one was sure that current practice does not please employers, almost three-fifths thought it does and a third had suggestions for improvement but thought it broadly satisfied them.

Even so, there are unanswered questions about the quality of these practices – diversity of practice is not a guarantee of diversity of good quality practices – and there is a problem understanding how the potential contained in good, diverse practices can be realised across the system of undergraduate engineering as a whole.

3. Strengths of current assessment practices

Informants valued the following aspects of current practices:

i) Some four fifths of the informants drew attention to the ways in which current practice provides uncompromised information about individual achievement. Some added to this the claim that these methods provide objective and reliable information about individual attainments.

ii) Half of the replies said it is important that current practice provides plenty of opportunities for authentic, practical and realistic assessment activities.

iii) A similar number referred to the ways in which current practices can be used to reward (and encourage) creativity, flexibility, synoptic thinking and similar professional practices.

iv) The importance of feedback to students was emphasised, especially rapid feedback. A few said that the opportunities for peer feedback are a strength of their assessment practices. In the words of

informant #35, 'by getting things wrong, students can demonstrate to the teacher where the problems of knowledge and understanding lie, so that they can be corrected. Students also have feedback in advance of exams, and the opportunity to practise standard techniques.'

v) The range of assessment methods in use was seen as a strength by a third of the informants.

vi) A similar proportion of replies drew attention to the opportunities for assessing communication and teamworking skills. Rather fewer mentioned time management as something valuable that is addressed by common assessment practices.

A system for assessing performance against output standards would need to have these strengths but trying to create a system might expose tensions between the what are identified as strengths of the present system and disconcert engineers who are broadly satisfied with present assessment practices. For example, the output standards imply more authentic assessments (strengths ii and iii), which would also imply the use of a broad or broader range of methods (strength v). The problem is that it is expensive, difficult or even impossible to get reliable judgements when a range of methods is being used to estimate performance on authentic tasks. It is also harder to be sure that it is individual, unassisted performance that is being observed, which means that it is not possible to be confident about an individual student's 'true' ability. Given that a strength of the system as it stands is that it provides reliable and secure judgements of individual, unassisted achievement, the assessment of output standards might be viewed with some suspicion. Matters could be even more complicated than this if it turns out that assessments that now provide reliable and secure data about individual achievements are based on more-or-less objective tests of information and of formulaic use of routines to solve fairly standard problems related to single modules. Such tests have their place but the output standards refer to far more complex achievements that are not susceptible to such assessment

techniques.

The point is simple. The most frequently mentioned strength of the current system is that it provides secure and reliable assessments of unassisted individual performance. Other strengths, which are congenial to the output standards come second to it. Unfortunately, the output standards value complex achievements that often cannot be reliably (or reliably and affordably) judged. The wish to have valid assessments of complex learning interferes with the current emphasis on reliability and security.

4. Points of stress in current assessment practices

The Learning and Teaching Support Network's Engineering Centre at Loughborough recently published a summary of responses to its question, 'What are the top three assessment issues for engineers?' (http://www.ltsneng.ac.uk/hec/been_said/index.htm). If further evidence were needed that assessment is problematic, this summary provides it. Plagiarism and the assessment of groups were key issues, alongside the question that occupies the EPC's Assessment Working Group, namely how to assess in ways that ensure that learning outcomes and deeper learning are achieved. The summary also shows uncertainty about criteria-referenced assessment, assessing transferable skills, using a range of assessment methods appropriately and giving feedback to students. This survey suggests that there is already a lot of uncertainty about what to do and how best to do it, which implies that the introduction of the EPC output standards will put more stress on the system.

It is widely appreciated that academic staff frequently experience stress as they try to reconcile various roles – teacher, practitioner, researcher, administrator and advisor, to name five. A clear implication is that anything that increases workload and role conflict will be resisted, explicitly or covertly, irrespective of its merits. On the other hand, innovations that promise some easement of stress are more likely to get a fair trial.

Informants were asked about points of stress in their assessment systems in the hope that it might then be

possible to make recommendations about the assessment of output standards that would not exacerbate matters and which might even promise some relief. Three problems dominated their responses:

a) The semester system is the main reported source of stress in the assessment system. No-one had anything good to say about it. Complaints were that it led to a bunching of assignments, that scripts had to be marked to tight deadlines, leading to what one person called 'severe time compression'.. Reference was also made to fragmentation and to the difficulties of scheduling complex and authentic assessments in semester-long courses (by the time students have learned enough to be able to tackle complex assignments there is not enough time left for them to undertake them). Opportunities for formative assessment could be similarly restricted.

b) Time was widely felt to be in short supply. One informant concluded his response with the words, 'I'd love to chat but I'd rather give my next project students some more formative assessment' (Informant #20). Improved quality assurance procedures, tightening up double marking practices, for example, added to pressures on time.

c) New assessment methods were valued but seen as costly, particularly in the sense of demanding a lot of time (for students to do them and for teachers to mark them).

Two other pressure points were each mentioned half-a-dozen or so times, namely:

1. Large classes and rising student numbers.

2. The difficulty of detecting plagiarism, which was exacerbated when new assessment methods supplemented or supplanted individual unseen tests and examinations.

In some systems students are over-assessed. Informant #18 said,
I am very concerned that HE itself is being over-assessed

and that the time has come for a cool look at what procedures are necessary and those which might be interesting should we ever have some spare time between teaching, research and other necessary QA procedures. Over-assessment drives students into a surface approach to learning and is likely to do the same to academics and provision of learning opportunities.

It was anticipated that the assessment of learning outcomes would add new problems to the assessment pressures that informants had already identified. In some form or another half of the respondents said they were concerned about the demands that this would make upon their time. More specifically, there was a concern that it would take time to understand the outcomes, relate them to established practices and translate them into familiar language. Informant #16 said,

As acknowledged in the EPC Output Standards document, the learning outcomes that it contains are not written in wholly familiar language and an assessment scheme based on them would probably require a fair amount of effort to implement. To begin with, the EPC exemplar benchmarks would have to be translated into language that every colleague could readily understand. At present we are intending to map our learning outcomes onto the QAA benchmark, in which the knowledge, skills and understanding are separately identified rather than being "wrapped up" in an "ability to" statement.

Others mentioned the amount of time it would take to design new assessment standards and practices into programmes and courses, while implementing the design would take expertise and time. Three people predicted that they would run into trouble if they tried to change assessment practices so that they all dovetailed with the output standards because colleagues would see this as an attack on their academic freedom. Five others were worried by the implication that they would have to restructure their whole assessment programme, irrespective of whether staff jibbed at perceived threats to academic freedom.

It has already been mentioned that some informants thought that the task of adapting assessment practices to

the output standards would be particularly time-consuming because the standards themselves remain problematic, being over-ambitious, ambiguous or unclear. A couple of more gloomy informants said that the standards are inherently and fatally flawed - unable to do that which they claim – while five were concerned by the competing demands of different definitional exercises, most notably between the QAA benchmarks and the EPC output standards. For example,

The interpretation of the EPC Output Standards needs to be thoroughly tested. It is damaging to generate unrealistic benchmarks/output standards without proper consideration of the resources required. My concern is that bodies external to university engineering departments will have much greater expectations as a consequence of these standard as written than is indicated in the exemplars in the EPC Occasional Paper No. 10. (Informant #15).

Others were simply unsure how the output standards, as currently expressed, could support the finely differentiated marking on which the whole grading and degree classification systems rest. For example,

We very much like the EPC output standards but as they are at the moment they could only be used as pass or fail, would not enable the Hon's classification to be used. If used on their own would lead to an NVQ style of assessment, which would be expensive in staff time. (Informant #23)

The fourth question, then, exposed a number of serious concerns about the assessment implications of output standards. Although few expressed serious doubts about the output standards themselves, their concerns are fundamental. Worries about the time costs of changed assessment procedures revealed a lot of uncertainty about how the output standards were to be interpreted, what would be involved in assessing them and how they might be used to get the fine gradings that university administrators expect. Not surprisingly, when asked how these problems might be alleviated, informants said that they would be helped by

- The output standards being clear, unambiguous, fully

illustrated and accompanied by detailed guidelines on good assessment practices.

- Plenty of time to work out the difficult and profound implications of moving to an ambitious criteria-referenced system of curriculum planning and assessment practice.
- Skilled help, partly in the shape of training for academic staff but also in the form of consultancy support at departmental level. Two informants said that in-house champions with assessment expertise would really be needed.

A number of other ways of making it more likely that good assessment practices could be developed to support output standards were mentioned by one or two informants: more administrative support, longer degree programmes, more technical staff for the assessment of laboratory and practical skills, support from senior figures in the university, reform of the external examiner system, reductions in paperwork, a reduction in the content to be covered, and increased funding.

5. Two implications of the output standards

The second part of the questionnaire asked about two assessment implications of adopting the EPC's output standards, namely:

a) The standards relate to complex learning, not to simple learning of information or algorithmic problem-solving techniques. If such complex learning is to be promoted, then the curriculum will need to be planned at the programme level (that is the direction taken by the Quality Assurance Agency which requires departments to have programme specifications in place by October 2002). So too with assessment. For example, one face of reliability is repeated observation of an achievement in different contexts and by different observers. For this reason, if no other, a programme-level assessment plan is called for. Question 7 asked about this.

b) The EPC's Assessment Working Group has

considered whether student learning portfolios would offer a valid way of assessing complex, long-term learning, especially achievements that are hard to judge by means of commonplace assessment techniques. However, it is aware of the considerable difficulties that portfolio assessment can cause. Question 6 was designed to see how much expertise engineering teachers have in the use of portfolios to assess student learning.

Assessment plans

The responses to question 7, about assessment plans, indicate that engineering departments would have a lot of planning to do in order to make sound arrangements for assessments of the learning outputs. While it is quite clear that module or course-level assessment plans exist, are valued and are helpful for staff, students and external examiners alike, a programme assessment plan can hardly be satisfactory if it is just the product of its unorchestrated components. The main problems are

a) Consistency: expectations and grading standards tend not to be consistent from course to course, which makes it hard for students to bring what they have understood in one course to another.

b) Coverage: some output standards get over-assessed (because they are easy to teach, easy to assess), while others get neglected, being taught incidentally, if at all, and assessed in passing, if at all.

c) Coherence: in the absence of programme-level thinking about how one module relates to the others, the course lacks coherence, even at the basic level of an account of how programme learning outcomes are assessed and when. Appendix 3 shows the alternative in the form of a statement on programme assessment, followed by an extract from a course handbook which explains how the module assessment relates to the programme specification.

d) Progression: if there is not thinking about how students are to progress from limited achievements to the

demanding attainments described by the learning outputs, then it is likely that courses and modules will not be well aligned to promote progression. Audits of practice done within the 'Skills plus' project, managed from Lancaster University, show four common impediments to progressive learning:

i)   Some outcomes are hardly addressed, if at all;
ii) Some outcomes are addressed and assessed in the first year only;
iii) Some key outcomes are addressed and assessed in some optional classes but are scarcely to be seen in core modules;
iv) Some outcomes are over-taught and over-assessed – inefficiently so.

Seventy per cent of responses to question 7 said that there was not a programme level plan in place. In the case of the 25% saying that there was a plan, there were some indications that this amounted to a synthesis of module level plans, which would mean that it would not count as a plan in the sense of a plan that brings consistency coherence, coverage and progression to teaching, learning and assessment arrangements for the programme. The comments that informants made about assessment plans showed that some, at least, saw benefits (a plan spreads the assessment workload, allows students to plan their time better, makes it clear to all involved what is to be done by whom and when and 'can tell [you] if learning outcomes for individual units and the whole course are being achieved' - Informant #46).

There were some reservations about assessment plans on the grounds that they take time and effort to construct, can reduce flexibility, may limit academic freedom and depend on all teachers constructing shared understandings of what the plan prescribes. Of course, these could also be seen as potential strengths - as Informant #46 put it, 'Unit co-ordinators need to think carefully when setting work [about] what they are trying to achieve in terms of learning outcomes in relation to the Aims of the Unit'. These are

important points because the logic of the EPC's output standards, of QAA benchmarks and of the QAA's requirements for programme specifications is that curriculum and assessment plans will need to be consistent coherent, extensive and progressive as never before.

In one sense this is not a great cause for concern because although it is demanding and takes time to make good assessment plans, it is something that can be taught, learned and done successfully. It is something that can yield to good in-service learning and curriculum development projects (such as 'skills plus').

Portfolios

Seventy-three per cent of informants said they had no experience of using portfolios for assessment purposes. This would have to be taken into account were the EPC to commend portfolio assessment as a way of generating evidence of achievement in relation to the output standards.

Those who had used them were likely to use them both formatively and summatively, although assessment experts tend to advise against giving a formative and a summative role to the same piece of work. Three informants said that they associated portfolios with work placements. The other seven informants who used portfolios provided no further details.

Informants were asked to identify things that might discourage them from adopting portfolio assessment. Eight difficulties were mentioned, each by one or two people: time costs, the need for good assessment criteria, the need to make requirements and expectations very clear, the dangers of plagiarism, complexity, the challenge of making finely-differentiated judgements in portfolio assessment, the need for assessor training, and the impossibility of offering portfolio 'resits'. Few mentioned any advantages. Those identified were that portfolio assessment is suitable where complex learning needs to be appraised with validity. Clearly, there is much to be done if portfolio assessment is to be commended, and it needs to be done against a background of hard-pressed academics feeling that the assessment system is already under stress. And although it

is not too hard to teach people how to introduce and manage portfolio assessment, there are technical difficulties to be considered. If portfolios are used for summative assessment there are considerable problems and costs associated with the need for reliability. I am not persuaded that anyone has yet come up with an efficient way of summatively assessing portfolios without limiting their validity to the point where it is reasonable to ask whether portfolio assessment has any advantages left. An alternative is to use portfolios formatively, explaining to students that they are a way of developing and testing claims to achievements that the department cannot warrant. They also serve as compilations of evidence to substantiate those claims. Appendix 4, which contains extracts from the documents given to students who keep a formative record of achievement in order to enrich their claims to employability, illustrates this use of portfolios Portfolio assessment may be part of the logic of output standards but there are real difficulties attached to any attempt to follow that logic.

6. Ideally …

The case for bringing greater order to the assessment of student learning was put by informant #30.

Most UK employers understand the difference in standards between different institutions. The broad understanding is that post-1992 universities have low standards and pre-1992 universities have high standards. This is unfair to the few 'good' post 1992 universities and unduly generous to some poorly-performing pre-1992 universities. Hence, the establishment of common output standards would assist employers.

The wide variation in standards between different higher education institutions in the UK is particularly confusing to foreign employers. One particular example concerns students from Ruritania who attend our courses in relatively large numbers. The progress of these students is overseen by the Government of Ruritania on behalf of a number of Ruritanian employers. Students from Ruritania are sent primarily to either Big New University or Big Civic

University to study Control engineering. The Dean of this Faculty at Big Civic recently had to deal with a complaint that groups of students that were of apparently equal academic standard when they left Ruritania to study in the UK had distinctly different mean degree classifications when they returned to Ruritania at the end of their course. Those studying at Big Civic University received a mean of a 2.2 Honours degree whereas the group of apparently equal academic ability received a mean of a 1st class Honours degree from Big New University.

Six informants were broadly happy with the way that assessment works in their institutions. One said,

We have a free hand, and we have spent years developing our current assessment system. Hence we think it is good. We continually review and update it to maintain the best system we can. Surely this is true for all departments? (Informant #23).

True though that might be, there were plenty of suggestions for change. Individually, none is original but, taken as a set, they show people interested in making engineering assessments more authentic and valid. Suggestions included:

- Fewer formal examination.
- 'More formative and less summative – it's the formative assessment that really helps students to learn' (Informant #20).
- Greater specificity and clarity about assessment practices, expectations and criteria.
- More collaborative and group assessments.
- ' I would like to see more emphasis on integrative project work and less on syllabus content. This would generate the diversity which the engineering sector needs. The change in emphasis in assessment would be to enhance the A2 in the higher levels of taxonomies such as that of Bloom etc. It would also be more motivational, if initially more challenging, to the student cohort'. (Informant #18).

- Doing more to emphasise and assess non-engineering skills, especially communication, planning and management skills.
- More oral assessment.
- Introduction of personal development records. [Otherwise known as 'portfolios'?].
- 'I am a strong proponent of functional testing for the vocational and professional courses. These are projects, portfolios investigations, etc. I do feel that our main problems within the HE sector is the invalidity of assessments, and the wild belief in the reliability of unseen examinations (even when there is research to show its ineffectiveness in predicting professional success)' (Informant #22).
- 'Enhanced, substantial design assignments' (Informant #45).
- 'Assessment need not be so radically different to that currently deployed. It could require both students and staff to work collaboratively. One example in my department is an examination in which students are posed a brief and incomplete outline of a problem. Working initially in groups, but then individually, they use the invigilator as a consultant to obtain further student specified data to define the problem before moving to propose and justify solutions.' (Informant #18).

At the same time there was also a concern that any changes to assessment systems should be compatible with the need for practices that are quick, efficient and effective, for, as has already been said, these teachers are working in demanding situations with little, if any space, for innovation.

There is a problem here for the EPC. On the one hand there is little disagreement with the proposition that Engineers in higher education should give an authentic account of what graduates should understand, be able to do and be sensitive to. On the other, curriculum and assessment arrangements that are intended to promote

those achievements, rather than trusting that they will emerge spontaneously and be recognised easily, mean changing current practices, depend on Engineers learning new things, call for new resources and require even more effort from those who teach. The goals – a better account of what an engineering degree should mean and curricula that are designed to align student learning with this ideal – are admired but there is a fear that the resources, expertise and time that are needed to make the goals into realities are not present in anything like the quantities needed. This is about complexity and simplicity. What assessment arrangements are faithful to the complexity of the output standards yet simple enough to be adopted by engineering teachers, a minority of whom are, in any case, dubious about the output standards themselves?

Recommendations

1. Although this survey provides plenty of evidence about assessment patterns, surveys do not give good information about the quality of practices. For example, unseen examinations can be appropriate means of assessing some output standards but they can also be quite inappropriate. A great deal depends upon the quality of the examinations. It is likely that some, perhaps many, examinations assess simple learning achievements and not the more complex ones identified by the output standards. In other words, it may be harder than this survey suggests to match assessment practices to the vision of the output standards. The EPC is urged to bear this in mind when discussing the resource implications of disseminating the output standards.

2. The EPC is advised to continue to consider how best to illustrate the output standards clearly and precisely to as wide an audience as possible.

3. As part of its dissemination strategy the EPC might publish worked-out assessment tasks that illustrate ways of making judgements about achievement in terms of the output standards. This is not cheap because it requires small, trained writing groups

working with some editorial supervision.

4. Teachers in higher education say they are short of time and that existing assessment arrangements cause them difficulties. The implication is that it will be difficult to accommodate the assessment implications of the output standards unless they can be presented as saving some time that can then be allocated to the fresh demands of assessment geared to the output standards. A paper considered at the end of 2000 by the Assessment Working Group suggested that time could be saved by reducing the summative assessment load and compensating through less expensive formative assessment.

5. Assessment audits help to identify areas for attention in programme provision. The document in Appendix 3 comes from such an audit. Departments might be encouraged to make auditing a prelude to changing assessment practices to align them better with the output standards.

6. If the output standards are to be assessed well, programme-level assessment plans will be needed. According to this survey's informants, it is unusual to have such plans. The EPC is encouraged to think about ways of familiarising academic leaders with them, which might be combined with advising departments on the production of QAA programme specifications.

7. Informants identify a need for assessment training. There is research evidence suggesting that it works best when it is intensive and complemented by consultancy work on specific, local problems. It is recommended that EPC explore ways of strengthening local capacity in criteria-referenced assessment.

8. There is evidence from other sources that a problem with improving the educational quality of degree programmes across higher education is that academic leaders, notably heads of department, do not have expertise in academic leadership, curriculum and

learning design and assessment practices. The EPC might wish to explore the possibility of seeking funding for a national pilot programme in head of department leadership education.

9. University departments are likely to welcome greater integration of the work of the LTSN engineering Subject Centre (Loughborough), the Quality Assurance Agency and other interested parties. The EPC might wish to explore ways of taking a lead on this.

Appendix 1.

The Survey instrument, March 2001.

The Engineering Professors Council, Assessment Working Group

This is a request for five minutes of your time. You are welcome to give us more of it.

If you can do nothing else, please answer questions 1-4 and send us your response. Short answers are better than nothing: long answers will be read with enthusiasm. You could be even more helpful by going on to questions 5-9 and/or by passing this on to colleagues who could help us to understand better what happens in your department.

Email systems tend to scramble layout. A cleaner version of these questions is in the attached file. [FILE ATTACHMENT HERE]

Thank you for attention.

Peter Knight, Educational Research, Lancaster University, Lancaster, LA1 4YL

1. Please list five methods your department regularly uses to assess student learning.
   [You are welcome to list more, or to attach departmental documents to your reply, or to post them to the address above.]

2. Please list up to five strengths of the ways in which you currently assess student learning
   [You are welcome to list more, or to attach departmental

documents to your reply, or to post them to the address above.]

3. What are the points of maximum stress in your assessment arrangements - what needs attention or is causing problems?

[You are welcome to extend your answer by attaching departmental documents to your reply, or by posting them to the address above.]

4. Suppose you had to assess student learning in terms of EPC Output Standards or another taxonomy of learning outcomes. What do you think would be the difficulties?

5. What help or resources would you need before you could adopt such an approach to assessment?

Thank you very much for your time. If you have the time for another five questions, please keep going. If not, please send your answers to xxx

6.. Do you think that the ways in which we currently assess student learning satisfy employers? Please explain you answer.

7. Have you any experience of using portfolios for assessment purposes?

Regardless of whether you have experience of using them, we would be glad to know your views about them - what might be their costs and potential advantages?

If portfolios are used in your department, are they used

Formatively   - to give students feedback for improvement?

Summatively - to provide marks or grades for degree classification?

Summatively and formatively?

We would be glad to see copies of any material on the use of portfolios to assess student learning.

8. Has your department an assessment plan for the whole four (or three) years of the undergraduate programme that shows what is being assessed and how?

If you do not have a programme assessment plan, Please identify any things that would make it hard to create one.

Say whether you see any possible advantages in having a plan

If you do have a programme assessment plan, please Identify any benefits that come from it

Highlight any problems or drawbacks with it

9. Given a free hand, how would you have engineering students' learning assessed?

10. Like any questionnaire, there is a fair chance that this one has not asked the best questions to find out what you would advise us to do as we think about assessing student learning in engineering with Output Standards in mind.

Please add any further comments here, or; refer us to papers you have found useful, orput us in touch with other people interested in these issues, or; send us copies of documents used in your department.

Thank you.

Appendix 2

Fifty-five assessment techniques

There are as many assessment methods as we can imagine are fit for the purpose in hand.

Some are well-established as ways likely to support reliable, affordable summative judgements. Others are

best as stimuli to learning conversations.

All benefit by learners having a good idea of 'the rules of the game' and of the criteria that identify what is being valued.

With low stakes, formative assessment, questions also arise about who is involved in making judgements - the learner, other learners, outsiders or tutors?

1. Annotated bibliographies.
2. Artefacts/ Products, especially in fashion, design, engineering, etc.
3. Assessment as gatekeeping: entry to classes on production of bullet point summaries etc.
4. Assessment of performance on a sample of questions from a question+answer bank.
5. Assessment of work-based learning (in a variety of ways, many times, by a variety of people, for different purposes).
6. Book, website or program reviews.
7. Classroom assessment techniques. Brief tasks that tell the teacher something about the class's grasp of the material. (See Angelo and Cross, 1993).
8. Completing structured summaries of readings, debates etc.
9. Computer-based self-assessment.
10. Contribution to threaded electronic discussions.
11. Defence of lab records.
12. Design and build (similar to 2, above)
13. Dissertations and theses.
14. Double-loop assessments (formative summative).
15. Electronic monitoring of web searches, program use & communications.
16. Essay writing - one 5000 word, piece (make harder/easier by varying amount of tutorial guidance, range of reading expected, novelty of the topic/problem, time available, conceptual complexity, etc.)

17. Essays writing - 2x2500 word pieces.
18. Exhibitions.
19. Field work and lab work assessment (traditional and well established).
20. Formative assessment of logs/journals/portfolios (when the purposes are formative, students identify areas for discussion. If summative, sampling recommended.)
21. Games and Simulations.
22. 'General' assessments, drawing together learning in several modules.
23. Making annotated bibliographies for next year's students.
24. Making concept maps.
25. Making designs, drawings, figures, tables or plans.
26. Making models (literally, in some subjects, conceptual models in others).
27. Making web pages.
28. Multiple choice questions (they do not have to be only tests of information, although it is a lot quicker to write MCQs like that. See also 4, above).
29. New tests in which learners use old software/programmes/notes.
30. Objective Structured Clinical Examination (OSCE).
31. Open-book, end of course exams.
32. Orals and vivas.
33. Performances.
34. Personal response assessments. Usually done in classes where each student has an electronic response pad. Teachers ask questions and they press a key to show their answer. Can be used for classroom assessment or test purposes.
35. 'Pop' or 'pub' quizzes in classes.
36. Portfolios. (see also 49, below and 19, above).
37. Posters.

38. Problem-based learning - quality of diagnosis, suggested solution, problem analysis, etc.
39. Problem-working and completion exercises.
40. Production of course reader for part of next year's course.
41. Production of structured logs of project/dissertation progress and reflection on it.
42. Projects.
43. 'Real' problem working, which involves defining 'fuzzy' situations and bringing some order to ill-defined issues.
44. Replication of published inquiries.
45. Role playing.
46. Self-assessment (students complete the self-assessment column on the standard coursework cover sheet -- see handout 5).
47. Seminar presentations (in or out of role; with or without use of video, OHT, Powerpoint, etc.).
48. Short answer questions. (MCQs plus)
49. Short appraisals of target papers.
50. Small-scale enquiry.
51. Submission of claims to achievement with reference to portfolio (grade on the claim alone but only if sufficient evidence is present).
52. Takeaway papers/questions/tests.
53. Terminal, unseen examinations.
54. Writing exams/tests/assessments to tutor specification.
55. Writing memoranda or journalistic summaries.

This is based on Brown, S. and Knight, P. (1994) Assessing Learners in Higher Education. (London: Kogan Page) and Hounsell, D., McCulloch, M. and Scott, M. (Eds.) (1996) The ASSHE Inventory (Edinburgh: University of Edinburgh and Napier University). For Classroom Assessment Techniques, see Angelo, T. and Cross, P. (1993) Classroom Assessment Techniques. San Francisco:

Jossey Bass.

(a) Sample programme specification, document 5. Assessment opportunities and skills.

Programme outcomes are assessed in four main ways.

1. Students get feedback when their performance is notably awry. For example, after the first year it is assumed that students will give appropriate references in good style (10.2 A.5). [This is a reference to a learning outcome identified in the master programme specification document.] Tutors give feedback when faced with evidence that this background assumption is not valid. By default, feedback will be formative, although summative penalties can be applied - the standard cover/feedback forms illustrate this. Other outcomes that are particularly likely to be assessed in this way are: 10.2 B1, B3 and C4.

2. Tutors provide a large amount of formative feedback orally (especially in tutorials and seminars) and in response to student email requests for advice. In addition, some use small group work to evoke peer feedback that challenges, modifies or amplifies student thinking and deliberately set in learning tasks to this end. This feedback can relate to any and all of the programme outcomes, depending on the particular module, student and need.

In order to understand better the remaining two ways in which outcomes are assessed, it is helpful to look at the department's default cover/feedback sheet. The grade indicators indicate that assessors are routinely interested in the knowledge outcomes (10.1) and in intellectual skills (10.2 A. Notice, though, that the indicators recognise that the opportunities a student has to demonstrate any one learning outcome in a particular piece of work will vary and it is not likely that any one piece would provide strong and direct evidence of performance on all eight of the outcomes listed in sections 10.1 and 10.2 A. Where work is not easily graded by reference to these indicators, supplementary

ones are provided (EDS 231, 232, 300).

As mentioned above, This system also picks up on shortfalls in work organisation (10.2 C4, penalties for lateness), referencing and English (10.2 B5, 6), requirement to revise and re-present).

1. Students get written formative feedback on all assessed coursework. The standard cover/feedback form directs marker's attention particularly to outcomes 10.1 and 10.2A, 10.2 B5 & 6, 10.2 C4 and invites them to make suggestions for future improvement. External examiners frequently comment favourably on the quality of this feedback.

   Successful performance on some pieces of work may depend upon success on learning outcomes that are not themselves directly assessed: for example, EDS 300 grades may directly attest to information handling and research skills (10.2 B1, 2) but that rests upon all of the outcomes listed in 10.2 C and probably 10.2 B3 and 4 as well.

2. Examinations, like coursework, tend to directly assess outcomes 10.1 and 10.2 A, although the quality of examination performance is related to the level of mastery of other outcomes, notably 10.2 C4 (organisation of revision), 10.2 C2 (taking responsibility for examination preparation), 10.2 C1 (thinking afresh about the information, concepts, skills etc. constituting the course) and 10.2 B1 (coping with complex files of notes, photocopies, URLs etc.).

b) Extract from a module handbook showing relationship of assessment tasks to learning outcomes

By the end of the course, you should:

1. Demonstrate knowledge of mainstream educational and social research methods- see Programme Specification outcome 10.2B (2).

2. Critically engage with issues concerning the relationships between research and knowledge, and with the fitness of different research methods for different purposes- see Programme Specification 10.1

    (2).

3. Have skill at reading and evaluating research reports - see Programme Specification 10.2A (1), 10.2B (1).

4. Be able to design a feasible, small-scale research inquiry- see Programme Specification 10.2B (1, 2).10.2C (3).

5. Take responsibility for organising and managing much of your own learning- see Programme Specification 10.2C (2, 4).

6. Work effectively with others, both to their benefit and yours- see Programme Specification 10.2C (5, 6).

7. Treat the Internet as a mainstream learning resource - see Programme Specification 10.2B (3).)

8. Present your conclusions orally to an audience- see Programme Specification 10.2B (6).

This table links these outcomes to the main pieces of assessed work you will do.

Task	O1	O2	O3	O4	O5	O6	O7	O8	O9
Coursework 1 literature review									
Coursework 2 research design									
Coursework 3 evaluaton of a paper									
Bullet point lists									
Examination notes, Q.1									
Examination inquiry design, Q.2									

Appendix 4

Introduction to profiling

What is a Profile?

Your profile is a working document for you to use ..throughout your time here. Eventually it will provide invaluable documentation of your learning in HE. Your increased understanding of what you are learning and how

you learn best (which you study in term 3 of the Part I course) help you to establish claims to the skills that employers value and to engage with the career planning that is central to getting employment and admission to postgraduate courses.

A key principle of profiling is that you can make more powerful claims if you are fully aware of what you have learned and are able to document your achievements in a convincing manner. The undergraduate programme for Majors in the Department is designed to foster a wide range of achievements, as shown in Table 1, overleaf). Together, they make a powerful contribution to your employability.

Our programmes are designed to promote the learning achievements shown overleaf but they are not the only contributors to them. Some skills and understandings you bring with you to university. Others are enriched through your out-of-class engagements, whether through participating in university clubs and societies, part-time work, or leisure, social and family experiences. A profile that is intended to help you lay claim to high levels of employability should contain evidence from all of these sources so as to show that your claim to achievement is broadly-based, not dependent on one piece of evidence taken from one course you took in your first year here. This means that you are welcome to make claims to learning achievements that are not included in the department's programme specification. Table 1 is not intended to restrict claims, only to identify things that are very much to the fore in the department's teaching.

This profile is a public account of this extensive learning. A programme of classes runs throughout the undergraduate programme for Majors in the Department and helps you to make and refine the profile and to be skilful at career planning and management. These support sessions help you to identify achievements and directions for development. They are organised by the Chair of the Undergraduate Committee and are additional to the contributions made by mainstream classes. The third

term's work in Year 1 is very much about learning and employability but there is also a further orientation class in week 10 of the first term. In Year 2 there are two-hour support classes with input from careers staff at 12.00 on Wednesdays in weeks 6 and 16 and in Year 3 classes are in weeks 4 and 14.

So, although it seems a long way ahead, by the time you graduate, you should have a profile of your strengths and evidence of the activities you have undertaken in order to develop them, which you can use to make effective job or course applications.

Programme outcomes. Things to learn from the degree programme.	Elaboration of the outcome statements
10.1 Knowledge outcomes: Knowledge of	
1. A changing set of discourses & evidence concerning teaching, learning, etc.	Learning about & developing your own position, based on evidence, on educational issues
2. How to make intelligent use of social science perspectives applied to education.	Understanding & knowing how to apply concepts such as 'cultural capital' or 'development' to illuminate questions about, for example, inequalities or underachievement.
3. Educational arguments in relation to contested positions, principles & values, with special care for analysis & critical assessment	Appreciating how ideologies underpin competing positions on, for example, approaches teaching of English , citizenship etc. Plus critical capabilities (10.2 A1, below)
4. Research skills in application to valid problems in education.	Understanding & showing how research approaches have been applied to educational issues; assessing the value of findings

10. 2 A Intellectual skills, notably	
1.Critical capabilities - selects, analyses, synthesises & evaluates perspectives in terms of their principles & concepts	Bringing together your understanding of perspectives on child development & exploring their implications for educational practices.
2. Argumentation - justifies rationally & in a freely chosen way personal positionings on educational matters.	Making a sustained & well-supported case for your position on gender inequalities & their causes in schools
3. Open-mindedness - able to reflect upon &, as appropriate, accommodate to new perspectives, arguments, ideas & evidence.	Showing you can carefully fairly weigh arguments, including ones counter to your position, & to alter your position as appropriate
4. Tolerance of ambiguity - avoids taking a simple position if it is inappropriate to decide an issue one way or another.	Seeing, for example, causes in social life, paradoxes in some educational policies, pros & cons of perspectives you support etc.
10.2 B Practical skills, notably	
1. Information-handling - locate, retrieve sift & select information that is fit for the purposes in hand.	Searching for books & articles on-line & in more traditional ways; differentiating between relevant & irrelevant, useful & less useful etc.
2. Research skills - generate questions, review relevant information sources, select suitable research strategies, collect, analyse & interpret data,	Demonstrating skills at a novice level, but covering all aspects of research, from design, through implementation to reporting

present findings appropriately.	
3. ICT - use www, departmental websites, email etc. to identify relevant data	Using, but not to creating, these resources & using them in a discriminating way
4. Number - read intelligently data summaries based on a range of standard descriptive & inferential techniques.	Being able to understand what the numerical data mean & interpreting them for the purposes at hand
5. Conventional - follow referencing, orthographic & grammatical conventions	Using the system of referencing properly & consistently & writing in a reader-friendly way, according to standard practice & conventions
6. Presentational - conveying conclusions orally & in a variety of written forms.	Presentations, essays, reviews, short papers, posters etc.. You are advised to have strong evidence of oral and written accomplishments.
10.2 C Transferable skills, that, taken together, show flexibility and adaptability	
1. Reflectiveness - appraise own achievements, learning methods & self-theories	Looking at what you do, why and how.
2. Independence - takes responsibility & initiative: learns through self-organized &, increasingly, self-directed study.	Developing increasing levels of autonomy: not relying on your lecturers for guidance, support & feedback
3. Problem-working - engages intelligently with novel situations	Applying knowledge & understanding acquired in one situation appropriately to

	another
4.Work organization - meets deadlines.	Meeting ones for you and ones you set yourself
5. Interpersonal - learns partly through networking (face-to-face, electronic), being active in communities of practice.	Working with others, sharing & developing ideas informally or formally
6. Groupwork - can work in a team & lead when appropriate.	1. Show that you can work with others and help the group to work effectively 2. Show that you have led groups successfully.

10. 3 Key principles in an effective learning culture are that

1. People's beliefs about successful achievement matter considerably in life.	Understanding that having skills, knowledge & understanding is not enough - attitudes & values are also important for success
2. People usually have choice about how they interpret situations, react & feel: Those with high self-efficacy are likely to act differently from those with learned helplessness.	Appreciating that those who think that others have control over (& are to blame/praise for) their failures & successes are usually less effective & successful than those believing the opposite
3. Commitment & persistence count. Persistent people attribute achievement to effort & strategic thinking. They expect to find ways to ease difficult situations.	Recognising that much success is due to perspiration as much as to fixed intelligence
4. Metacognition.	Reflecting on what we know

Knowing what you know & having control of how you know are associated with your achievement.	and on how we can use it and how we learn more

Three key aspects of compiling your Profile

- Review and reflection: regular review of your course-related work and extra-curricular activities enables you to identify areas of strength to be built on and those which need to be developed. Your record will provide an account of your progress in connection with your academic work, your leisure activities and development of general skills. Reflecting on these will help improve your learning, increase your self-confidence, focus your thinking about career options and contribute to an effective CV. The Profile will also help your tutor provide a well-informed reference for you, in providing information about your academic qualities and achievements in a wider context.

- Self –awareness: review and reflection of what you have done and what you have learned foster greater understanding of yourself. This insight relates to your knowledge and aptitudes, your capabilities and skills, your values and attitudes, and to recognition of development needed for your future career. Employers of all kinds are interested in graduates who are competent in their degree subjects and who have well-developed personal skills – which are often acquired as a result of extra-curricular interests and a variety of work experience.

- Auditing activities and evidence: as part of the reviewing and reflecting process, this is the means by which you are asked to record the ways in which you are developing. This is designed to prompt you to think not only about what particular skills or aptitudes you may have (and to what level of competence or confidence), but to note the evidence that leads you to these conclusions.

Table 2, overleaf, helps you to identify about skills you are

likely to have enriched in various parts of the BA programme. If you have identified a skill you would like to develop further, Table 2 shows you the modules you could take in order to give it especial attention.

Your role and responsibilities

Your Profile is your document; it is your responsibility and you are the most important person in its development and maintenance. Your responsibilities, therefore, are to:

- maintain and develop your course-related and personal knowledge and skills
- maintain and develop your record of progress in these, your aptitudes and capabilities in your Profile
- set yourself realistic and attainable objectives – and go for them
- make the most of your time in HE
- be prepared to experiment, to try something new (to you)
- attend meetings with your tutor.