

The quality of materials graduates

By Professor Peter Goodhew, April 2001

In the March issue of Materials World, Caroline Baillie described some of the qualities which employers look for in Materials graduates and argued that, although a University undergraduate course might not be able to inculcate all of them, different attitudes to teaching and learning methods might help.

It would be hard to find anyone to disagree with the assertions that we need to attract good recruits to our discipline and that our universities and colleges should strive to produce graduates of high quality. It gets more difficult when we try to define “good recruit” or “high quality”. It is probably helpful to start at the end: In order to know which graduate qualities should be “high” we need to specify what we are producing graduates **for**. From my perspective, as a scientifically-educated, thoughtful, caring, willing member of UK society (sorry if you don’t recognise me) I suggest that we want Materials graduates for all of the following purposes:

- To contribute to wealth-creating industries, some but not all of which will be engineering-based;
- to help educate the next generations of scientifically-literate and responsible citizens;
- to fill key positions in society and exercise influence with an educated awareness of the significance of science, technology and engineering, and;
- to contribute creative ideas wherever they go.

A look at the first destinations of new graduates and the mid career positions filled by many Materials graduates of the sixties, seventies and eighties indicates that our graduates did, and do, contribute widely to society (and not just to “industry”). In the light of this, we should perhaps not be too concerned about the quality which was produced in the days before the phrase “quality assurance” entered education. However, we do now live in a world of “accountability”, “audit” and “quality assurance”, and it is necessary to make explicit some aspects of our systems which were hitherto implicit. So, to get back to the question, what are the qualities we need to develop in graduates and how might we monitor and assure them? This is a difficult issue, so let me just propose some ideas in order to stimulate debate and (with luck) provoke some response. I will start with some “qualities” – which are not necessarily the same as “skills” and certainly not what are currently called “key skills”.

- The ability to be *inquisitive* and to *understand* many of the key ideas and concepts which underpin the discipline of Materials. These key concepts must exist, or we have no validity as a distinct discipline. Specifying them is however not easy – as anyone who has tried will have found (for some insight into the problem I recommend Robert Cahn’s recent book “The Coming of Materials Science” and a paper by Adrian Sutton which can be found on the UKCME Web site www.materials.ac.uk/).
- The ability to *explain* these ideas to others who have not benefited from a Materials education.

- The ability to explain how important these ideas are to our society and to explain how they can be used *responsibly*.
- The ability to *innovate* and contribute to the development of science, engineering or other aspects of society.
- The ability (and the wish) to work with others, whatever their background or expertise.

Five qualities is enough to be going on with. I would be happy that a graduate in whom these qualities are well developed would be able to play any of the roles I outlined above. It is worth looking at some of the words which do not feature in my list: There is no mention of any specific material, nor do the words “know” or “knowledge” appear. The key concepts of the discipline are hugely important but their application to any specific material or class of materials is only significant (in the educational context) in that it illustrates the potential power and usefulness of the concepts. If we identify the key concepts successfully they will have a very long term validity and will be applicable to all existing materials and to **any** new material or new application which comes along at any time in the graduate’s working lifetime.

Recruiting the students

If this argument is accepted, how does it affect our attitudes to recruiting young people to the discipline and to appropriate methods of quality assurance? Recruitment first: Three key words in my list of desirable qualities are “inquisitive”, “understand” and “explain”. How might we select and/or encourage to enter our discipline, people with the potential to be good at these three things? For most young people, all the primary data we have to go on are GCSE and/or A-level results. I have recently taken the time to map the requirements of a first year Materials degree course on to the GCSE and A-level syllabi of Curriculum 2000. We actually **use** only a tiny fraction of the content of these syllabi, and this small amount could be taught (to a receptive student) in a couple of weeks. What we actually need, and therefore should be specifying, is proven ability to understand, demonstrable interest and potential clarity of explanation. It matters little **what** has so far been understood, or **what** the area of interest is or **what** can be explained. It is the generic abilities we seek. It would be more rational if universities admitted, into Materials courses, students with a good result at something (preferably demonstrating numeracy) and the ability to explain to us why they are interested.

Assessing the quality

How then might we “quality assure” the educational process and the graduate output? We might try trusting university colleagues to do their very best, which in my experience they do, but this appears to be unacceptable to government who still hold most of the purse strings. So academics will swallow their pride, accept the implication that they cannot be trusted and submit to sensible scrutiny. But do we currently have sensible scrutiny? The major current QA mechanisms are *SPR* (now called *Academic Review* or *Subject Review*) set by the QAA and *Accreditation*, set by the Engineering Council via the Institute of Materials. The first of these assesses process and the second (largely) content. Neither mechanism considers measures of output quality or the important attributes I have identified above. Neither appears to offer a positive feedback mechanism to encourage higher quality recruits.

I do not believe that there are at present any well-developed alternatives, but we could (and should) at least think what a better mechanism might involve. Here are some initial thoughts:

- It should look at outputs – i.e. the quality of graduates
- It should be developmental – i.e. tending to improve the quality of both graduates and the educational process
- It should not inhibit innovation either in education or in materials
- It should be responsive – i.e. keep pace with a rapidly changing external environment
- It should encourage – particularly potential recruits to the discipline

A Graduate College

Here is an outline suggestion for a new mechanism which could replace both Accreditation and Academic Review. It is radically different from anything we currently do, but it does, I believe, address most of the issues raised in the previous paragraph.

- Establish a national pool (a “graduate college”?) of about 20 graduates from each year – volunteers but with a threshold degree attainment, perhaps an upper second. College members will need to undergo training but college membership would be (in CV terms) a prestige appointment.
- Set up panels from this college to visit each Department of Materials at about graduation time – each panel to consist of about half a dozen graduates, drawn from college members graduating 1, 2, 3, 5 and 10 years ago. Panel members would usually not be graduates of the department they are visiting. The panel might be chaired or advised by a more senior figure.
- Ask each panel to interview every graduating student, asking about what they had learned, teaching/learning methods, especially good experiences etc
- Each panel would feed back a written report to the Head of Department for comparison with previous years’ reports. Each report would be sent to the central coordinating body (perhaps the Institute) but also to every graduating student, and (perhaps in edited form) to their schools.

This type of mechanism ensures that comments are relevant to **current** employment practice (because it is carried out by very recent graduates); it ensures rapid response to changing circumstances; it can be used to promote recruitment; it encourages appropriate innovation, and; it employs communication between graduates and graduands. Would it be worth a try?

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