Developing Professional Skills

John Wilcox

How will you help them to learn this?
DISTANCE LEARNING
PBL
CASE STUDIES
LABS
TUTORIALS

How do you find out if your teaching is useful?
EVALUATION

How to attract students and who will they be?
ATTRACTING STUDENTS

What do you want them to learn?
PROFESSIONAL SKILLS
MATERIALS CHEMISTRY
ENVIRONMENTAL MATERIALS
MATERIALS FOR ENGINEERS

How will you find out what they have learnt?
ASSESSMENT

UK Centre for Materials Education
Encouraging students to create a personal profile
INTRODUCTION

Many of our community, lecturers in the disciplines of and relating to Materials Science and Engineering, have expressed interest in simple-to-use guides to support the workshops we run on learning and teaching. As part of our ‘Thematic Groups’ scheme, we have established 12 themes for this special focussed support, each of which is led by a ‘Thematic Group Leader’. During the first two years of the scheme, workshops have been held on these themes and this has enabled the leaders to further explore relevant issues with lecturers and feed the results into this series of booklets.

Learning and teaching is a continuous cycle represented in the diagram below:

We can start at any point around the cycle. If we are in the business of teaching it certainly helps if there is someone to teach! Not such a funny joke in the current climate with reducing numbers of students in technical disciplines. Hence one of our main concerns is how can we approach schools and work with school students to attract them into Materials areas. 'Attracting Materials Students' by Cheryl Anderson explores how we can work with schools and the wider community to ensure a diverse and inclusive group of able students on our courses. Once we have a class to teach, what would we like to teach them? The first reaction to such a question is to make a list of topics or knowledge. However, this is only a beginning, and a very limited one. Not only are there are many skills and attitudes that we
would like them to develop, but learning is more complex than simply the what. It also involves the how. ‘Developing Professional Skills’ by John Wilcox explores the approach to empowering students to track their own skills development as they progress. ‘Materials for Engineers’ by Mike Bramhall, ‘Materials Chemistry’ by Stephen Skinner and ‘Environmental Materials’ by Cris Arnold, focus on what we might like to include in a specialised curriculum, for targeted students. The knowledge, skills and attitudes or learning objectives identified for each course must be assessed if we are going to give credit to students for learning what we want them to learn. ‘Assessing Materials Students’ by Lewis Elton gives support to the development of assessments and assignments that do in fact give marks for those things we want to acknowledge, rather than those aspects that are simply easy to assess!

Believe it or not it is only at this stage that we can really consider how we should teach the students to learn these things. We all know about lectures but will we use in addition or instead: tutorials (‘Tutoring Materials’ by Adam Mannis and Shanaka Katuwawala), labs (‘Teaching Materials Lab Classes’ by Caroline Baillie), case studies (‘Teaching Materials Using Case Studies’ by Claire Davis and Elizabeth Wilcock), problem based learning (‘Learning Materials in a Problem Based Course’ by James Busfield and Ton Peijs) or even learning at a distance (‘Learning Materials at a Distance’ by Mark Endean)?

The final stage before we start all over again is to see if we have done what we intended to do. We may have already found out whether, and how effectively, the students learnt what we wanted them to (i.e. if the assessment matched the learning objectives and if our teaching methods suited the students’ learning approaches). If this has not proved to be as ideal a scenario as we would have wished we will need further input to analyse what has happened. ‘Were the course objectives inappropriate?’ ‘Did the students take on surface approaches to learning because of my teaching?’ Ivan Moore’s ‘Evaluating a Materials Course’ will give you the tools of the trade to conduct your own thorough evaluation and enable you to develop an improved course for next year’s cohort. Which brings us back to the beginning of the cycle. ‘Are we attracting students with appropriate abilities for this course?’ And on it goes …

In writing these booklets, and running the workshops we have had a lot of fun and we hope that you catch the flavour of this in using them. Stay in touch and give us feedback about your ideas in implementing any of the suggestions. As a community we can learn most from each other.

Caroline Baillie and Leone Burton
Editors
WHY THIS BOOKLET?

What will I learn tomorrow? Let me put it another way. I hope that tomorrow will be interesting, and will challenge me as a professional. I don’t want to have to do the same old tasks that I have spent the last ten years repeating, honing my skills in narrow areas to perfection. I want new experiences, so that I can continue to grow as a professional.

Furthermore, by continuing to learn, I can re-awaken part of myself and reconnect with the world that my students inhabit. I can rediscover the frustrations of not being able to understand fundamental concepts or master essential skills, and I can again experience the joy of success and the fear of failure. I can remind myself of the value of the great teacher and of great teaching. I can experience first hand the hurdles we place in front of those who wish so much to learn.

In any case, learning is good for the soul. It leads to regeneration and growth, without which our intellects will wither. It leads to a questioning approach and to reflection on experiences from which both we, and our students, benefit – and if that questioning and reflection take place in view of the students, then it will also influence their own approach.

Of course, there are many other reasons for signing up to continuing professional development, and we will look at these in more detail below.

OBJECTIVES/AIMS

This booklet has two principal objectives. The first is to highlight the skills required for successful, lifelong professional development. These skills, like many others in life, can only be acquired by coaching and by practise. The second objective, therefore, is to suggest strategies and methodologies that can assist in the acquisition of professional development skills.

PERSPECTIVE

For many people in further and higher education, professional development is synonymous with short courses or with post-graduate qualifications. However, professional development is more than training or continuing education - increasingly it is recognised that learning also occurs in the work-place, as an integral part of working. Work-based learning focuses on solving real-world problems. The time and effort invested in the learning are immediately rewarded through completing the task in hand and the usefulness of such learning, together with the short-term nature of the rewards, improves the motivation to learn.
Professional development therefore covers a wide range of learning situations:

- Private study and reading
- Attending conferences and seminars
- Preparing papers and presentations
- Committee work
- Collaborative work with colleagues
- Conversation and discussions with others
- Courses and distance learning
- Researching the solution to problems
- Working with others outside the organisation

To these we might add the learning and development that take place when we are transferred to new situations, or when we take on new responsibilities within our existing job functions. Professional development also includes the full range of intellectual discipline, from conceptual understanding to the practical application of knowledge.

The informal and ad-hoc nature of much professional development poses problems for us as educationalists. How do we evaluate and assess it? How can we recognise and reward it?

Delivering professional development on demand to practising materials technologists using a variety of learning modes will require new approaches to teaching and learning, and should make use of modern information technologies, adapted and adopted for teaching and learning.

However, such matters lie outside the scope of this booklet.

**OVERVIEW**

We will start by reviewing the importance of both continuing professional development and the skills that enable it to take place. We will then define the terms ‘professional development’ and ‘professional development skills’. Finally, we will consider methods to identify and deliver relevant lifelong learning. These methods also provide the training regime through which we can become skilled at professional development.

**WHY ARE PROFESSIONAL DEVELOPMENT SKILLS IMPORTANT?**

Professional development is not a new concept, but it is becoming increasingly important. The continuing pace of change in materials science and engineering means that what we learned in our initial training courses soon becomes dated and irrelevant. It has been estimated that the half-life of technical knowledge is about seven years. Furthermore, the amount of knowledge – and the amount of information – continues to increase. Materials science and engineering has become knowledge intensive: we have entered the knowledge-based economy.

In this new world, it is impossible for us to know all that there is to know, yet access to the knowledge base is increasingly readily available. So what will make us good materials technologists, rather than poor ones, is that our knowledge is more relevant, and more current, and is applied more efficiently and effectively.

The work-place has also changed, with the result that materials scientists and engineers are expected to have a wider range of skills (see table 1). We increasingly work in teams on projects and much of what we do is virtual rather than tangible. As one project ends, another begins, and so we move from project to project, from team to team, and from one work-place to another. Indeed, for many, the increasingly itinerant nature of work leads us into several different careers during our working lives.

These are strong, compelling reasons for professional development skills, but there are many more!
A better informed and more sophisticated public is demanding a higher duty of care and level of service from professionals.

Linked to this is the increasing risk of claims for negligence from professionals deemed to have ‘failed’ in their duty or given poor advice.

Within organisations, modern quality management systems demand that qualified people are in place to make decisions.

**TABLE 1: THE SKILLS REQUIRED BY PROFESSIONAL ENGINEERS**

**Table 1a**

- Combine general and specialist engineering knowledge and understanding to optimise the application of existing and emerging technology.
- Apply appropriate theoretical and practical methods to the analysis and solution of engineering problems.
- Provide technical, commercial and managerial leadership.
- Communicate effectively and possess good interpersonal skills.
- Apply appropriate codes of professional conduct, recognising obligations to society, the profession and the environment.

Source: UK Engineering Council

**Table 1b**

- Transform existing systems into conceptual models.
- Transform conceptual models into determinable models.
- Use determinable models to obtain system specifications in terms of parametric values.
- Select optimum specifications and create physical models.
- Apply the results from physical models to create real target systems.
- Critically review real target systems and personal performance.

Source: UK Engineering Professors Council

**Table 1c**

- Apply knowledge of mathematics, science and engineering.
- Use the technical skills and engineering tools necessary for modern engineering practice.
- Design and conduct experiments, and analyse and interpret data.
- Design a system, component or process to meet specified needs.
  - Function in multidisciplinary teams.
  - Formulate and solve engineering problems.
- Interpret and employ guidelines on professional and ethical responsibility.
  - Communicate effectively.
- Apply knowledge of contemporary and cultural issues.
- Appreciate the impact of engineering solutions in the global and social context.
  - Work in teams or in collaboration with others.
- Information technology and management skills.

Source: US Accreditation Board for Engineering & Technology

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How can I encourage students to take an active approach to skills development?
If we do not respond to this challenge, we face the prospect of becoming irrelevant. If, as professionals, we assume that our old time-served competences will last a lifetime, we will find ourselves becoming candidates for redundancy. The organisations we work for equally run the risk of failing to provide the new products and services that the market requires, resulting in decline.

And so we need to learn continually as we work. This requires a skill set all of its own, a skill set we need to learn for ourselves as teachers and mentors, and a skill set we need to instil into our students for their future benefit.

WHAT IS PROFESSIONAL DEVELOPMENT?

Professional development is the process by which a person maintains the quality and relevance of professional services throughout his/her working life. It has been defined by the Institute for Continuing Professional Development as:

‘The systematic maintenance, improvement and broadening of knowledge and the development of personal qualities necessary for the education of professional and technical duties throughout the practitioner’s working life.’

It follows that we have an ethical responsibility as professional materials technologists to continue our professional development throughout our careers.

Professional development is not a product, devised by training providers and academic institutions. It is a mindset, a habit to acquire.

EFFECTIVE PROFESSIONAL DEVELOPMENT

‘Would you tell me, please, which way I ought to go from here?’

‘That depends a good deal on where you want to get to,’ said the Cheshire Cat.

‘I don’t much care where’ – said Alice.

‘Then it doesn’t matter which way you go,’ said the Cat.

‘So long as I get somewhere,’ Alice added as an explanation.

‘Oh, you’re sure to do that,’ said the Cat, ‘if you only walk long enough.’

Lewis Carroll (1865), p54

The European Society for Engineering Education (SEFI) has issued a discussion document (Padfield et al., 1998) with the intention of stimulating debate on professional education and lifelong learning for engineers. This document defines professional development skills as the ability of the learner, fluently and without external direction, to:
• audit and assess what they already know and can do

• work out, at a level of detail that will differ from individual to individual, a career and a learning development plan

• integrate, into their learning, acknowledgement of their need for continuing personal development in the private as well as the professional realms

• understand the qualities of different kinds of knowing, of understanding, and of skills and competences and understand how the different kinds of knowledge inter-relate and reinforce each other

• reflect upon their knowledge, establishing links between different kinds of knowledge, and formulating relevant theoretical constructs to explain it

• conduct research into elements of professional knowledge, practice and competence that lie within the context of their work, in pursuit of solutions to ‘problems of the day’, personal professional development, and (more generally) the development of their profession

The above is a list of ‘performance criteria’ by which we might assess our professional development skills. However, what is missing from the list is the route by which we might achieve these objectives. It is suggested that a five step approach is used:

**STEP 1 – Profiling Ourselves:** This is the starting point for our individual professional development plan and should contain the ingredients from the table below:

<table>
<thead>
<tr>
<th>The personal profile – based upon the Macmillan open learning course for Nursing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Life</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Skills inventory</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Values, attitudes and beliefs</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Learning skills</td>
</tr>
</tbody>
</table>

Encouraging students to create a personal profile
Developing our personal profile will make use of the reflective practices discussed in step 5.

**STEP 2 – Define the Strategy:** Our professional development needs to be correctly focused for maximum impact so that it meets both our individual development needs and those of the organisation for which we work (see Table 2 below). If our employer has in place an annual staff review and appraisal process, then our individual aspirations and the organisational goals may have been reviewed, and a training and development plan agreed for the foreseeable future. Otherwise, we should discuss our professional development needs with our manager and our training or human resources department.

Table 2: The differences between a Fragmented approach to CPD and a Focussed approach – based upon Willie (1991)

<table>
<thead>
<tr>
<th>Fragmented approach to CPD</th>
<th>Focussed approach to CPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not linked to organisational goals</td>
<td>Linked to both organisational and individual needs</td>
</tr>
<tr>
<td>Seen as a cost not an investment</td>
<td>Viewed as an investment in human resource management</td>
</tr>
<tr>
<td>Focussed on training (discontinuous) not development (continuous)</td>
<td>Focussed on on-the-job development and skills development in addition to knowledge-based training</td>
</tr>
<tr>
<td>Unsystematic</td>
<td>Evaluated with both pre- and post-course assessment</td>
</tr>
<tr>
<td>Menu driven, like ordering from a mail catalogue</td>
<td>About ‘learning’ as opposed to ‘training’</td>
</tr>
<tr>
<td>About directive training and knowledge acquisition</td>
<td>Transferred to action and change in the workplace</td>
</tr>
<tr>
<td>Viewed as unimportant, with course attendance frequently cancelled due to pressure of work or lack of commitment</td>
<td>Flexible in application including open, distance and self-development</td>
</tr>
<tr>
<td>Not transferred, with learning rarely being implemented at the workplace</td>
<td></td>
</tr>
<tr>
<td>Viewed as a reward for good performance</td>
<td></td>
</tr>
</tbody>
</table>

**STEP 3 – Develop an Action Plan:** Putting the strategy into action can be the biggest challenge. An action plan can help. An effective action plan has four key ingredients:

- A clear statement of the goal to be achieved
- The actions required to achieve the goal
- The target timescale for achieving the goal
- Criteria to assess when we have reached our goal

In order to deliver the action plan, we will have to seek out opportunities for learning and skills development, ideally in partnership with our employer. And since professional development benefits both the employee and the employer, we might find that our employer asks us to make a contribution to our own professional development, by committing some of our own time and perhaps by sharing the costs.

Having established our action plan, we next need to decide how we are to go about the learning process.

**STEP 4 – Learning Styles:** Research commissioned by the British Audio Visual Society in 1988 suggests that we remember 10% of what we read, 20% of what we hear, 30% of what we see, 50% of what we see and hear, 80% of what we say and 90% of what we say and do at the same time. For this reason, Fisher (2000) recommends that we integrate learning and working, so that we learn within the context of our work using real-world problems. Then the time and effort we invest in professional development is rewarded by immediately assisting us to complete the task in hand. Fisher believes the immediate usefulness of the learning greatly improves our motivation to learn.

Whilst this may be generally true for groups of people, as individuals, we each have our own preferred learning styles.

There are many ways to categorize learning styles, but the simplest places learners into one or more of three categories:
- Visual – those who learn best through their eyes and what they see and read. The ideal learning approaches in this case will involve studying magazines and books and learning online.

- Auditory – those who learn best by hearing things, either on tape or in discussion. Dialogue and discussion is important to their learning process. The ideal learning environment is the classroom, but discussions with colleagues and audio tapes can also be useful.

- Kinesthetic/Tactile – those who learn best by ‘doing’, such as taking their own notes or participating in demonstrations and hands-on projects. Ideal structure: magazine and online learning; classroom that encourages participation.

It is important to analyse the way we learn best before devising the learning strategy/action plan to achieve our goals. Like me, you might find the way that you learn changes as your grow older. I now find myself drawing upon my past professional experience to build new knowledge and understanding, whereas before I could assimilate facts almost effortlessly.

**STEP 5 – Evaluation and Reflection**

‘One day when Pooh Bear had nothing else to do, he thought he would do something, so he went round to Piglet’s house to see what Piglet was doing …. (To) his surprise he found that the door was open, and the more he looked inside, the more Piglet wasn’t there.’

A A Milne (1928), p163

As we have seen, good professional development relies strongly on self-analysis and appraisal to develop our personal profile and to analyse our preferred learning styles. This is not necessarily easy for a number of reasons. First, it can be hard to understand ourselves and ‘see ourselves as others see us.’ Second, reflecting on skills and competences is not something that engineers are necessarily trained to do. Third, as the pace of life continues to increase, it is not easy to find time for self-analysis and reflection.

Mentoring is one way of overcoming these problems. A mentor is someone who can advise and guide you in your career. He or she has a number of roles – as an appraiser, a supporter, a communicator and a motivator. The relationship therefore is different from that between a superior and his/her subordinate, and it is unlikely that a manager can carry out these functions. A good mentor has coaching skills, is trustworthy, respected and is free from major distractions either within or outside the workplace. Choose one with care!

Without a mentor, reflection is also not always a productive experience. It can be a bit like looking for Piglet – we can spend time thinking without arriving at a conclusion. It helps, of course, if we have a structure to our thinking. The key questions are:

- What is happening/has happened?
- What brought this about?
- What went well and what did not go well?
- How can the situation be improved?
- What might we learn from the situation that might influence future action?

It is recommended that we carry out this reflective evaluation both during and at the end of any task or learning we might undertake. One way of encouraging reflective practise in our professional life is to keep a reflective diary or log.
Many of us keep diaries that list our business or social appointments. Some of us also keep ‘to do’ lists. A reflective log is like a personal diary or record in which we note not just what we have done or accomplished, and what we have learned but also reflect on our feelings. What did we find difficult? What should we do to resolve the situation?

Often, a particular incident requires us to take a look at ourselves and our performance. Such critical incident analysis should be reported in the log or diary. As engineers, we make good use of major disasters and failures in our teaching and learning. However, when it comes to personal reflection, we should take care to include successes as well as difficulties so that we keep a balanced record of our achievement.

As well as providing a focus for us to reflect on professional experiences, the reflective diary also has a role in helping us to evaluate our learning. Some useful questions are: ‘Was the learning task appropriate to our needs? Was it efficient, achieving the desired outcome with the appropriate effort? Was it economic?’

Reviewing our reflective diary can also provide useful information. By looking back on our experiences, we can reassess our goals. What have we accomplished? What should the next steps be? This leads us naturally back to revisit and update our professional profile and our action plan.

And so the process continues....

Professional institutions are struggling to find ways of evaluating professional development. There is still a tendency to measure the inputs (number of hours) rather than the outputs (increased competence). The establishment of competence statements in the 3rd edition of Standards and Route to Registration as a professional engineer (SARTOR 3) by the UK Engineering Council provides a useful structure. The Institute of Materials, Minerals and Mining has adapted and developed these competences within the discipline of materials engineering and has specified over 100 areas in which Materials Technologists should demonstrate competence. However, whilst these are useful standards, we should remember that professional development is not a product or an outcome – it is a process.
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Other Booklets In the Series:

- Attracting Materials Students – Cheryl Anderson
- Environmental Materials – Cris Arnold
- Developing Professional Skills – John Wilcox
- Assessing Materials Students – Lewis Elton
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- Evaluating a Materials Course – Ivan Moore
Developing Professional Skills

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