UK SPEC and the RAPID Progress File: A Tool for Academic, Personal and Professional Development in Engineering

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Abstract — This paper describes a methodology for recording, monitoring, developing and planning academic, professional and individual development of engineering skills. This has been widely implemented through an online tool (RAPID) used by those who are wishing to pursue or are in the process of pursuing a career in engineering. RAPID is an engineering skills progress file, which was originally developed by Loughborough University as part of the UK's Department for Education & Employment funded project Recording Achievement in Construction (1998-2000). Further development since 2000 has resulted in eight discipline specific versions that have been used widely, across the HE sector, in construction and civil engineering disciplines. Currently there are 14 universities in the UK (and abroad) who are licensed to use RAPID, and to date over 3000 students have started to build a portfolio.

The paper provides an insight into the development of the generic engineering version (as part of the project 'Multi–skills for Advanced Engineering', funded by the European Social Fund), which matches closely the competence/commitment areas and levels presented in the newly launched UK Standard for Professional Engineering Competence (UK SPEC).

The paper also illustrates changes in emphasis in UK SPEC. For example, although UK SPEC was launched on 1st March 2004 to replace SARTOR 3, the level of competences has not been reduced. The new standard emphasizes inter-personal skills and increases the flexibility in possible routes to achieve the educational requirement, i.e. making the registration as professional engineers or engineering technicians more accessible to those coming from non-traditional routes. The level of required underpinning knowledge remains the same, although the evidence of competence required from engineering applicants will vary.

The competence based new engineering standard is found to correlate closely with the skills / competences within RAPID. The paper presents a mapping chart detailing the UK SPEC competence statements and the corresponding existing skills/competence areas in RAPID. The analysis demonstrates that the existing methodology and defined skills provide a flexible, easily accessible online tool, which enables the user to acquire/develop a personal awareness of skills and skills gaps through skills auditing. This encourages users to then take remedial action through the development of their competences by using a process involving action planning, reflection and the documentation of appropriate evidence. RAPID provides a comprehensive record of the individual's development and achievement of UK SPEC competences, thus providing the types of evidence required by UK SPEC for registration as a professional engineer or technician, and by the Initial Professional Development (IPD) and Continuing Professional Development (CPD) schemes of engineering professional institutions.

Index Terms — *Methodology, Skills, Professional Development, Progress File, UK SPEC*

INTRODUCTION

It is a known fact that 'the good engineer is not a person filled with engineering knowledge but that person skilled at accessing it and skilled at utilising it. In engineering technology knowledge is incidental to those skills. The education and training of engineers is the process of imbuing him or her with those skills' [1]. This fact has led to an increased emphasis in recent years on the processes and tools for the development of engineering skills and competences [2] –[6]. In the UK for example, all of the Higher Education institutions are expected by the Quality Assurance Agency (QAA) and Universities UK (UUK) to offer students by 2005/2006 a means of engaging in professional development planning. This emphasis on skills and competences is also reflected in the newly launched UK Standards for Professional Engineering Competence (UK-SPEC), which replaced Standards and Routes to Registration (SARTOR 3) on 1st of March, 2004. It is well known that standards provide proven measures against which to compare oneself and many engineering employers have developed their

own competence frameworks, which are recognised by various professional engineering institutions for professional development accreditation by enabling the companies to map their own competencies on to those required by UK-SPEC [7] for Chartered Engineer (CEng), Incorporated Engineer (IEng) or Engineering Technician (Eng Tech) registration. Research has shown that many different people, professional organisations, institutions and companies work towards the same competencies but with different terminologies. The challenge faced by the work described in this paper is to develop and present a meaningful and generally accepted personal and professional development engineering tool based on the competences framework described in UK-SPEC: a tool that will satisfy regulators and employers and facilitate individual development throughout a professional engineering career.

The aim of this paper is to describe a methodology for recording, monitoring, developing and planning academic, professional and individual development of engineering skills. This has been widely implemented through an online tool (RAPID) used by those wishing to pursue or are in the process of pursuing a career in engineering. RAPID is an engineering skills progress file, which was originally developed by Loughborough University as part of the UK's Department for Education & Employment (DfEE) funded project Recording Achievement in Construction (1998-2000). Further development since 2000 has resulted in eight discipline specific versions that have been used widely, across the HE sector, mainly in the construction and civil engineering disciplines. Currently 14 universities in the UK (and abroad) are licensed to use RAPID.

The paper provides an insight into the development of the generic engineering version, which matches closely the competence/commitment areas and levels presented in the newly launched UK Standard for Professional Engineering Competence (UK-SPEC).

ENGINEERING COMPETENCES AND UK-SPEC

The Engineering Council (UK) defines, in consultation with stakeholders across the UK, the UK-SPEC for professional engineers and engineering technicians in the UK. Those wishing to apply for CEng, IEng or Eng Tech registration are required to demonstrate competence and commitment in a number of areas. These competence and commitment statements, together with supporting evidence form the basis for the Professional Review. Development Action Plans and evidence records are expected to demonstrate that the competences are achieved to a standard appropriate to the applicant's job at CEng, IEng or Eng Tech level.

The new standard, UK-SPEC, is a development of the previous standard, SARTOR 3. A comparison of the two standards shows that

- The aim of launching the new standard is to 'make the registration procedures more flexible and transparent' [7] thus encouraging inclusivity and increased registration, as well as improved and more flexible assessment procedures. UK-SPEC increases the flexibility in possible routes to achieve the educational requirement, i.e. making the registration as professional engineers or engineering technicians more accessible to those coming from non-traditional routes.
- UK-SPEC includes two documents: one aimed at Chartered and Incorporated engineers and the second one for Engineering Technicians. This demonstrates the emphasis placed on the professional technician within industry.
- There is an emphasis on competence-based assessment in both the old and the new standard. The new standard, however, stresses the significance of Competences demonstrated in the Professional Review and supported by evidence, as a key measure of the professional engineer. This has led to the adoption of the Output Standards Framework [8] which is linked to the Competences and Commitment statements in UK-SPEC instead of the use of A-level entry grades as a major criterion for accrediation of degrees in the past.
- The level of competences has not been reduced. The level of required underpinning knowledge remains the same, although the evidence of competence required from engineering applicants will vary. The roles and responsibilities which provide the framework for assessing competence and commitment remain the same in both the old and the new standard. These are:
    - Competence: A Knowledge and understanding
      B Application to Practice
      C Leadership/Management/Supervision
      D Interpersonal skills
    - Commitment: E Professional Conduct

  Although the new standard appears to have a reduced number of competence substatements (e.g. A1 to A4 in SARTOR 3 and A1 and A2 in UK-SPEC, similarly B1 to B4 in SARTOR 3 and B1 to B3 in UK-SPEC) this is not because these areas of competence are no longer significant in the route towards registration, but mainly because a number of SARTOR 3 substatements have been joined to form a reduced number of substatements in UK-SPEC with a view to improve clarity. This has been achieved in the following form for CEng:
  - A3 in SARTOR 3 has been incorporated into A1 to form substatement A1 in UK-SPEC.

- A4 in SARTOR 3 has been incorporated into A2 to form A2 in UK-SPEC.
- Similarly B4 in SARTOR 3 has been incorporated into B3 to form B3 of UK-SPEC.
- D3 on Team building in SARTOR 3 has been incorporated in statement C3 of UK-SPEC.
- A new D3 statement emphasising personal and social skills has been added in UK-SPEC.
- In the area of Commitment, section E3 has been modified in UK-SPEC to include an emphasis on sustainable development.

The corresponding changes for IEng are:

- A3 in SARTOR 3 has been incorporated in A2 and the new A2 of UK-SPEC formed.
- B4 in SARTOR 3 has been incorporated into B3 and the new B3 in UK-SPEC formed.
- D3 on Team building in SARTOR 3 has been incorpoared in statement C3 of UK-SPEC.
- A new D3 statement emphasising personal and social skills has been added in UK-SPEC.
- In the area of Commitment, section E3 has been modified in the UK-SPEC to include an emphasis on sustainable development.

The changes for Eng Tech in UK-SPEC are:

- A separate UK-SPEC document for engineering technician registration.
- The inclusion of and emphasis on (*practical and technical) skills* in Statement A of UK-SPEC.
- Increased emphasis in UK-SPEC on effective communication (*in English* through a modified statement D1) and interpersonal skills through a modifed statement D2
- In the area of Commitment, sections E1 and E4 have been modified in UK-SPEC to include an emphasis on engineering technicians' involvement with their licensed institution.

It can be concluded from the above analysis that the main changes in terms of Competences in UK-SPEC are those related to interpersonal skills and sustainability with greater emphasis placed on these areas in UK-SPEC.

THE RAPID PROGRESS FILE

The RAPID (Recording Academic, Professional and Individual Development) Progress File was developed by Loughborough University as part of the DfEE funded project 'Recording achievement in Construction' (1998-2000). Since then RAPID has been widely used as an interactive web-based tool that enables students to engage fully in the processes of Professional Development Planning (PDP). Further development since 2000 has resulted in eight discipline-specific versions mainly within construction and civil engineering disciplines that have been used widely, across the HE sector. Currently there are 14 universities in the UK (and abroad) who are licensed to use RAPID, and to date over 3000 students (and graduates) have started to build and maintain a portfolio.

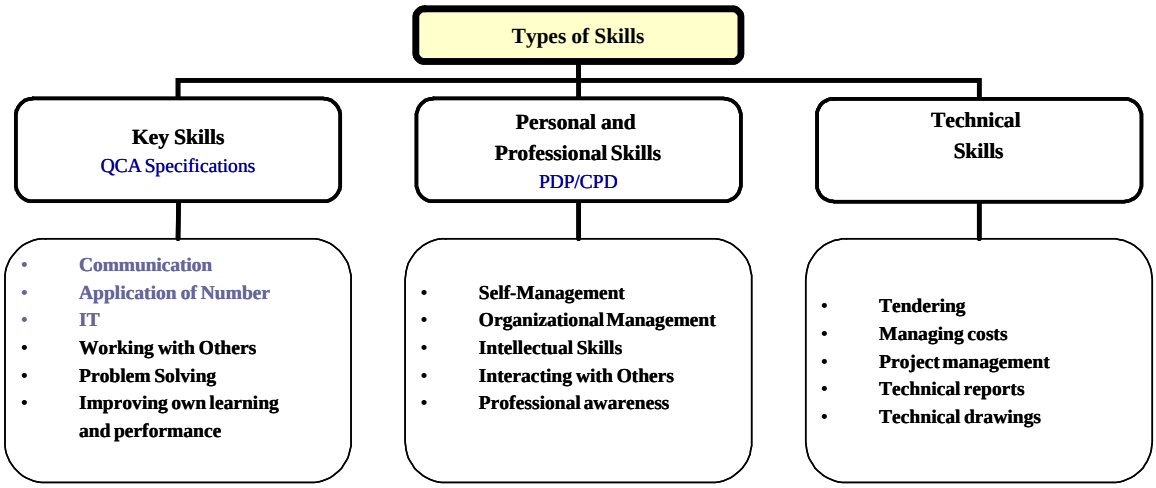
RAPID is an electronic (web-based) personal and professional development tool that allows registered users to input and maintain individual information on a password-protected database. In particular RAPID provides:

- A framework to create and maintain a comprehensive record of achievement and a framework to audit, develop and monitor skills compatible with the competence and commitment requirements of professional institutions/companies.
- A set of personal attributes and a set of skills that include Key Skills, Personal and Professional Skills and Discipline-orientated (technical) skills.
- A means to engage in auditing, developing, monitoring and reflecting on skill competences, enabling users to determine skill gaps and to take remedial actions through the development of action plans.
- An online, web-based platform that allows the user to access the tool from any location allowing this lifelong learning and development tool to be used –with minimal time commitment- by students, graduates and those working towards chartership, as well as for the Continuous Professional Development of professional engineers and technicians.
- A means to ease the transition from undergraduate study to a lifelong professional development.
- Access to online skills development resources.
- A means to create and maintain a Curriculum Vitae (CV) and gather evidence for job/placement/interview/appraisal and promotion applications.
- An online help facility, providing examples and guidance.

RAPID consists of two main components: PACE and SPEED. PACE (Personal information, Achievements, Career development record, Evidence folder) forms the CV (record of achievement) section of RAPID. The SPEED (Survey, Plan, Execute, Evaluate, Document) section contains fifty two skills divided into three main areas including Key Skills (based on

Qualifications and Curriculum Authority Key Skills) Personal and Professional Development Skills (Based on generic graduate and management competencies in Professional development programmes (PDP)/continuous professional development (CPD) programmes of professional institutions) and Technical Skills (based on discipline specific competence requirements) as shown in FIGURE 1 below.

FIGURE 1
THE TYPES OF SKILLS IN THE RAPID PROGRESS FILE



The methodology used to audit, develop, monitor and document skills and competences using RAPID is identical to the Professional Development Cycle [9] employed by professional institutions and involves the following steps:

- Carry out a skills audit and identify a skill development opportunity (Survey)
- Create an action plan (Plan)
- Execute a skill development plan (Execute)
- Review and reflect upon the activity undertaken (Evaluate)
- Document evidence of the competence/s gained (Document)

There are four levels of competence in RAPID. These vary from level A corresponding to NVQ level 2, level B corresponding to NVQ level 3, Level C corresponding to NVQ treshold level 3 / 4 to Level D corresponding to NVQ threshold level 4 / 5. The four levels in RAPID reflect the increase in autonomy, complexity and influence from level A at basic entry to level D at a very senior level in an organisation. The competence levels in RAPID mirror those employed by professional institutions (e.g. Categories A(Expert), B (Practitioner), C (Supervised Practitioner) and D (trainee) used by the IEE, IIE, IMechE and IoP [9]; Levels Follow/assist, Apply, Enable/Ensure/advice, and Initiate/influence/set strategy/inspire/mobilise used by the Skills Framework for the Information Age (SFIA)) and employers (e.g. Acquire, Apply, Expert in the Technical Maturity Model of Ford Europe Ltd [10]; Aware (level 2), Familiar (level 3), Skilled (level 4) and Expert (level 5) at Motorola Stotfold). RAPID competence levels also match the other types of grading systems for competence described in [11].

RAPID AND UK-SPEC

The RAPID competence framework covering core competencies in the areas of Key Skills, Personal and Professional Skills as well as the discipline-specific (technical) skills, has been compared with the new registration standards for engineers, UK-SPEC. Following an analysis of the relationship between the two, new Personal Attributes section was added to RAPID to match the increased emphasis on Interpersonal skills in UK-SPEC. The Personal Attributes section was developed to cover Creativity, Adaptability, Motivation, Assertiveness, Initiative Taking, and Resilience. Other additions to RAPID included the addition of Conflict Resolution to Interacting with Others section and Managing Sustainability to Professional Awareness.

A mapping chart mapping RAPID skills and competences to the competence and commitment statements in UK-SPEC has been produced and analysed. The analysis shows that the skills and competences in RAPID correspond closely to the competence and commitment statements in UK-SPEC. This strong relationship (demonstrated by the shaded boxes) is

presented (as an example) for CEng registration in the mapping chart in FIGURE 2. The titles and further details of the UK-SPEC substatements A1 to A2, B1 to B3, C1 to C4 , D1 to D3 and E1 to E4 are given in [7].

FIGURE 2
MAPPING CHART INDICATING RAPID SKILLS AND THE CORRESPONDING UK-SPEC COMPETENCE AND COMMITMENT STATEMENTS

	UK-SPEC															
RAPID	**A** Engineering knowledge and understanding		**B** Apply theoretical and practical methods to the analysis and solution of engineering problems			**C** Provide technical and commercial leadership				**D** Demonstrate effective interpersonal skills			**E** Professional conduct			
	A1	A2	B1	B2	B3	C1	C2	C3	C4	D1	D2	D3	E1	E2	E3	E4
KEY SKILLS																
• **Communication**										■	■					
• **IT**										■	■					
• **Application of Number**	■			■												
• **Working with others**			■				■	■				■				
• **Improving Own Learning & Performance**	■											■				■
• **Problem Solving**			■	■	■											
PERSONAL AND PROFESSIONAL SKILLS																
• **Self-Management**	■	■										■				■
• **Organisational Management**	■	■	■	■	■	■	■									
• **Interacting with others**	■	■		■	■	■	■									
• **Professional Awareness**	■	■	■		■		■		■				■	■	■	
• **Intellectual Skills**	■	■	■	■	■											
TECHNICAL SKILLS																
• **Tendering**	■	■	■	■	■	■	■									
• **Managing costs**	■	■	■	■	■	■	■									
• **Project Management**	■	■	■	■	■	■	■		■							
• **Technical Reports**	■	■	■	■	■						■					
• **Technical Drawings**	■	■	■	■	■											
PERSONAL ATTRIBUTES																
• **Initiative Taking**												■				■
• **Assertiveness**												■				
• **Adaptability**												■				
• **Motivation**												■				■
• **Resilience**												■				■

It can be seen from Figure 2 that the Competence statement A related to Engineering Knowledge and Understanding in UK-SPEC is represented within RAPID mainly by Personal and Professional Skills and the Technical Skills. The Improving Own Learning and Performance as well as Application of Number in Key Skills section of RAPID also correspond to Competence A of UK-SPEC. The relationship is based primarily on the application of such knowledge and understanding, rather than the content itself as also mentioned in [12]. The ability to apply theoretical and practical methods to the analysis and solution of problems in Competence statement B of UK-SPEC corresponds closely to Professional Awareness of Personal and Professional Skills, the Technical Skills, and also to Application of Number and Problem Solving of Key Skills. The Provision of Technical and Commercial Leadership Competence Statement C of UK-SPEC is represented in RAPID through Personal and Professional Skills (mainly Interacting with Others) as well as Technical Skills (mainly Project Management and Managing Costs). The competence statement D related to Interpersonal skills in UK-SPEC is represented in RAPID mainly through Personal and Professional Skills (Self-management), Personal Attributes and through Improving Own Learning and Performance, Working with Others and Communication and IT of Key Skills. UK-SPEC Commitment statement E related to Professional Conduct corresponds to Personal and Professional Skills (Professional Awareness and Self-Management) as well as Improving Own Learning and Performance of the key skills section of RAPID.

The above analysis shows that all of the competences and commitment statements of UK-SPEC closely correlate with at least three (out of four) categories of RAPID skills and attributes.

CONCLUSION

This paper describes a methodology for recording, monitoring, developing and planning academic, professional and individual development of engineering skills through a web-based, interactive tool (RAPID). It provides an insight into the development of a generic engineering version of the software. The paper also illustrates the competence framework and the recent changes in emphasis in UK-SPEC. It can be concluded from the work carried out in this paper that:

- There is a complete coverage of the UK-SPEC competence and commitment statements within RAPID. The skills and competences in the generic engineering version of RAPID correlate closely with the Competence and Commitment statements within UK-SPEC, making it possible for individuals and companies to focus their personal and professional development in an easily accessible and structured manner through RAPID.
- RAPID enables individuals and companies to assess/audit themselves and encourages individuals to develop their own skills in line with the requirements of the company and at the same time makes it possible for them to measure their progress towards professional registration. This enables the requirements of the company to be aligned with the development of the individual, and enables the company to recruit, retain, and enhance the competence of its engineering workforce.
- Operating a competence scheme described in UK-SPEC and implemented via the online tool RAPID eases the transition from undergraduate study to a lifelong professional development enabling an individual to start his or her personal and professional development as early as possible to maximise his or her potential/worth, and a company to operate a Professional development scheme to maximise the performance of its staff.

Work is currently in progress to further develop the generic engineering version in collaboration with professional institutions and also to implement this version with a number of Foundation degree and Sandwich Placement students as well as graduates working towards chartership in companies.

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