



HAL
open science

Recognizing non Formal Learning Experiences: Top-down or Bottom-up Approaches for Skills Alignment

Siegfried Rouvrais

► **To cite this version:**

Siegfried Rouvrais. Recognizing non Formal Learning Experiences: Top-down or Bottom-up Approaches for Skills Alignment. EDUCON 2012: 3rd IEEE Global Engineering Education Conference, Collaborative Learning & New Pedagogic Approaches in Engineering Education, Apr 2012, Marrakech, Morocco. pp.1-5, 10.1109/EDUCON.2012.6201157 . hal-00797529

HAL Id: hal-00797529

<https://hal.science/hal-00797529>

Submitted on 6 Mar 2013

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Recognizing non Formal Learning Experiences

Top-down or bottom-up approaches for skills alignment?

Siegfried Rouvrais

Telecom Bretagne, Institut Telecom

Université européenne de Bretagne

Brest, France

siegfried.rouvrais@telecom-bretagne.eu

Abstract—Adults have an active role in their own learning and training. Non formal and informal education is the cornerstone for a lifelong learning and career development. But related knowledge and skills, derived from several years of professional experience, personal development, or continuous vocational training, are hardly recognized in the formal education arena. Candidates for a diploma or qualification have to confront more or less referenced educational syllabus. For a better classification and promotion of individual knowledge and skills, and a more effective definition of associated competency proficiency levels, this paper investigates two approaches, supported with tools, so as to guide candidates in self-assessment and as such facilitate knowledge and skills validation by examination boards. As preliminary results, applied in two higher engineering qualification contexts at Master degree level, they show that: (i) when candidates directly rely on a formal syllabus in a top-down approach, they tend to limit the scope of their potentialities; (ii) thanks to reflexivity using a bottom-up approach, when candidates define from scratch their own syllabus, impacts on self-confidence and self-efficacy are much more significant. In the latter case, individuals better underpin their lifelong learning and training, and thus enhance quality of personal employment management and actions plans.

Keywords- *engineering education; continuing professional development; qualifications; certification; autonomy; self-confidence.*

I. INTRODUCTION

Within the European education and training framework, lifelong learning is defined as: “*all learning activity undertaken throughout life, with the aim of improving knowledge, skills and competence, within a personal civic social and/or employment-related perspective*” [1]. Lifelong learning is now a priority in many countries to strengthen the development of individuals in light of increasing global competition. Adults have as such an active role to play in their own education and training. Distinct from initial vocational education, non formal education (e.g. outside classical higher educational programs or curricula) and informal education (e.g. personal knowledge management) are the cornerstones of an adult lifelong learning and career development. To better support and recognize such continuous vocational education and training routes, many institutions across Europe have adapted their system of qualification.

On the one hand, higher engineering institutions award more and more their vocational diploma also on the basis of a vocational recognition of professional and life experience. In many cases, based on previous experiences, the candidate prepares and provides a thesis and has to defend his/her profile, knowledge, skills, and competencies in front of a jury. On the other hand, professional bodies also deliver some qualifications or certifications (e.g. chartered engineers), sometimes recorded in national registers and recognized by governments. On both cases, knowledge, skills, and competency syllabus have to be clearly defined and candidates have to overcome their complexity so as, ultimately, to try to align their personal profile therewith.

In order to better align with the expected learning outcomes defined in syllabus and associated proficiency levels, several approaches could be conducted. A top-down approach is first described in this paper, where the syllabus is initially presented to the candidate. After several iterations, the candidate is able to position his/her knowledge and skills within such frame and to gain some confidence in covering the main required professional activity domains. A bottom-up approach is secondly presented. Deeply rooted in reflection-on-action principles [2], it proves to be more time consuming but to have a deeper impact on self-confidence and self-efficacy.

For purposes of presenting the preliminary results on the comparison of the bottom-up and top-down approaches, this paper is structured as follows: following section II reviews syllabus and associated concepts in engineering education; Section III presents some examples of qualifications/certifications based on life experiences and continuous vocational training in the higher French educational engineering context; Section IV clarifies the top-down and bottom-up approaches as regards knowledge and skills alignment; Section V details tools which were used in the both approaches: (i) in a top-down approach, by candidates aiming at obtaining a certification as *Technical Architect of Information Systems*, managed by a professional body, and (ii) in a bottom-up approach, by a candidate seeking a qualification of professional and life experience in a *Networks and Telecommunications* master of engineering diploma. Before analyzing results in Section VI, dynamic tools are presented in Section V, specifically proficiency matrices.

II. SYLLABUS IN ENGINEERING EDUCATION

There are various kinds of engineer's qualifications or certifications, e.g. those managed by professional bodies or those managed by the ministry of education and higher engineering institutions. This study took place in the context of two distinct models: (i) a professional certification where the candidate assessment model was fully delegated to professionals (e.g. chartered engineer), and (ii) a qualification of professional and life experience fully managed by an accredited academic institution based on its classical syllabus for student initial vocational education and training (cf. master of engineering program).

A. Professional Bodies, Certifications and Competencies

In some countries, a professional and engineering council can define rules for professional practice certification. With its own professional bodies, the council maintains a register of professionals. It supports admission based on education, professional practice and examination or interviews by professionals. The examination panel could include social partners. The professional body determines required standards, which are most often close to the market needs in term of competency requirements. As such, the focus is mainly on competencies (e.g. skills in a professional situation including resources).

B. Diplomas and Syllabus in the Academic Context

In many countries, recommendations or directives for education are piloted by the government. It controls diplomas, most often in consultation with professional bodies. To improve the quality of academic programs, non-governmental organizations also accredit programs in various disciplines. In the engineering context, one of these organizations is ABET [3] which proposed the "a trough k" rubrics as a learning outcomes rulebook. Other well known boards also define reference syllabus, e.g. EUR-ACE, *Engineers Australia*, the *Canadian Engineering Accreditation Board*, or the *Commission des Titres d'Ingénieurs* in France.

In order to prepare the next generation of engineers, the twelve standards of the CDIO educational framework [4] offers many keys for reforming or continuously improving engineering programs. Proposing a detailed and extensible syllabus for engineering education, the CDIO standard #2 is a reference model rather than a prescription for intended learning outcomes in engineering. It is exhaustive and addresses technical knowledge and reasoning, personal and professional skills and attributes, interpersonal skills, as well as specific activity domains on conceiving, designing, implementing and operating systems.

It is recognized that the tension between real engineering practice skills and engineering disciplinary knowledge is hard to manage in curricula. In fact, skills are context dependent and then should be learned in a technical context by future engineers. As such, more and more practices are introduced in integrated curriculum, e.g. project-based learning methods [5]. For purposes of granting a diploma, an institution most often relies on its curriculum and associated

courses to enhance and assess student proficiency levels regarding the syllabus. Following an outcomes-based assessment model, formative and summative assessments are integrated all along a curriculum, either in direct (e.g. exams, assignments, observations) or indirect modes (e.g. portfolio, internship reviews) [6], at best aligned with intended learning outcomes [7].

III. ASSESSMENT OF PROFESSIONAL AND LIFE EXPERIENCES

In order to assess the aptitude and proficiency levels of a candidate to exercise a qualified engineering professional activity, we have seen in section II that various models are in place worldwide. In France, some professional certifications are formally recorded in the *National Register of Vocational Certification*, such as the *Technical Architect of Information Systems*. For this profession, the competency syllabus is divided into five activity domains; each domain comprising approx. ten core competencies. Public or private educational institutions can propose dedicated education and training programs (e.g. six months part-time apprenticeship or continuous vocational program). In this case, they also prepare candidates for the thesis, examination, and interview. Candidates can however present by themselves in relying on their professional and life practical experiences.

In the academic context, it is now possible in France to obtain a formal diploma based on validation of professional and life experience. It allows individuals, with several years of experiences e.g. through paid or unpaid professional work, to be recognized for their skills and learning. It is however hard and still uncommon to award a diploma, initially associated with a formal curriculum, thanks to professional and life experience. Candidates have to convince a jury, comprising academic professors, that they have learned and developed a range of knowledge and skills, without being continuously assessed. Moreover, educational programs and syllabus are defined more or less rigorously which may lead to ambiguities among stakeholders having different concerns (e.g. the candidate, the jury).

IV. TOP DOWN AND BOTTOM UP APPROACHES FOR KNOWLEDGE AND SKILLS ALIGNMENT

An educational program could rely on three main pillars, pursuant to constructive alignment principles [8]: (i) an intended curriculum representing the syllabus, (ii) a taught curriculum including teaching and learning activities, and (iii) a validated learned curriculum. Placed at the center of program descriptions, those three views share concepts, such as learning outcomes [9]. Whether regarding competencies assessed by professional bodies to obtain a certification or as regards knowledge and skills assessed by academics to obtain a diploma in the way of validation of professional and life experience, the taught curriculum is more or less missing. The candidate still has to prove his/her proficiency levels with respect to a wide range of learning outcomes, be it knowledge, skills, competency, or even attribute oriented. For this, he/she mostly has to rely on the reference syllabus specifying the certification/qualification or diploma.

A. *The Top-down Approach: Projection on a Syllabus*

The simple way for a candidate to verify the completeness of his/her profile with respect to a qualification or diploma is to take advantage of a well defined syllabus, and check and map, line by line, his experiences in comparison therewith. Proficiency levels, associated with elements of proof, may then be established. However, the task is not so simple for the candidate, even for a professional expert in engineering. Terminology and concepts are sometimes subject to ambiguities, and the individual experience can blur the broader scope of a skill or competency. Moreover, a syllabus is sometimes generic and too abstract for a candidate, missing some details that a jury or board of examiners could focus on. For this reason, it is largely recommended that a candidate use the help of a vocational counselor.

Even more knotty is the relative learning experience associated therewith. With respect to an educational learning taxonomy [10], following such an approach focused principally on comprehension of terminology and concepts, and analysis and evaluation: the candidate is forced to make verifications based on proficiency levels through judgments.

B. *The Bottom-up Approach: Archeology*

The candidate could be asked to define by himself his/her knowledge, skills and competency, and as such create an individual syllabus. The approach could be decomposed as follows:

1. Retrieving his/her various experiences through career and life (being formal or informal) will help to recall his/her personal and professional identity [11];
2. Extracting meaning from those different experience elements, recognizing concepts like knowledge, skills or competencies can prove useful;
3. Interpreting, organizing and demonstrating those concepts and associated instances in a personal model (e.g. skill syllabus) will permit to deeply reflect [2] on the experiences and question transferable skills;
4. Analyzing the model and being able to distinguish characteristics between the various elements will facilitate deeper investigation on relations among concepts and previous career path;
5. Evaluating proficiency levels on a home made model will enhance judgment objectivity and facilitate decision support regarding experiences to shed light on;
6. Finally, putting elements together to form a coherent whole will facilitate the creation process (e.g. for the thesis) and enhance personal system thinking skills.

Much more time consuming than the previous one, and requiring analytical and systemic skills, this approach is however richer with respect to an educational learning taxonomies [10], as discussed in Section VI. Once a personal syllabus is defined and structured, a candidate is much more comfortable with alignment, even more when the reference syllabus used by a jury is not updated with the recent professional practices, or does not include clearly transferable skills.

V. DYNAMIC TOOLS

Several tools are available for counseling candidate during the preparation of their final deliverable, such as skills audits, career advice, or portfolios. In all cases, candidates should be able to describe their skills and competencies, so as to identify their strengths and weaknesses in term of proficiency levels, and reflect on them. For such, in the bottom-up approach presented, a candidate relies on two specific tools: a proficiency matrix to draw up an overall dynamic picture of his profile, and an action plan to further reflect on it.

A. *Proficiency Matrices*

A proficiency matrix is a kind of curriculum map including proficiency levels. It could be organized in a tabular form, including experiences (e.g. formal or continuous learning, professional activities) and skills. An intersection is filled with a value when the specific knowledge or skill is addressed by a particular experience. The value represents the proficiency level, e.g. using an ordinal scale or a scale like <nil, conscious, autonomous, masterful, expert>. Fig. 1 presents such a matrix, self-elaborated by a candidate (a 4x8 sub-matrix is zoomed on the top left of the Figure). Representing more than 20 years of professional experience, with 64 missions and continuous trainings in lines and 113 skills in columns, it allowed the candidate to dynamically check and organize lines, columns and proficiency levels all along the archeology and analysis process. To clarify situations, each line supports details like context, volumes (e.g. number of colleagues, duration, hierarchal organization during a mission, financial aspects). By questioning skill and competency classes (e.g. column grouping), it helps to define some significant zones (e.g. islets) to focus on in the final written report, keeping in mind proficiency levels to shed light on.

B. *Action Plan*

Based on a refined knowledge of his/her own resources, skills and limits (e.g. identifying missing resources or resources to be developed to ensure proficiency levels), an action plan is a projection in the future to prepare lifelong learning. Thanks to a personal proficiency matrix and a reference syllabus model targeted, drafting an action plan allows candidates to identify steps needed to carry out their personal and professional project, and argue for the diploma or certification ached for. It allows to identify strengths and limits to consider in the future and thus to take reasoned, concrete, and pondered actions. Moreover, it better prepares

a strategy aiming at mobilizing and developing individual competencies.

VI. PRELIMINARY RESULTS

Employees are more and more regularly stressed by changes in the labor market. In fact, it is still their responsibility to maintain their competency portfolio as well as expertise levels. Those competencies can be recognized by diplomas, qualifications, or certifications. For example in France, to obtain a higher education diploma or professional certification based on validation of professional and life experience, a potentially large report has to be provided by the candidate. In most cases, it should address a problematic,

review some significant professional experiences, and provide clear elements permitting the examination board to shape its judgment. However, for the candidate, preparing this report is a sensitive phase (e.g., duration, complexity), especially since there are currently no formal rules in this area. Nothing but a syllabus is provided as a reference model to align with. As such, without the support of a counselor, several candidates did not complete the process due to misconceptions, were less positive or objective in their self-assessment, and ultimately had a hard time satisfying the jury requirements in terms of potential and skills clarity.

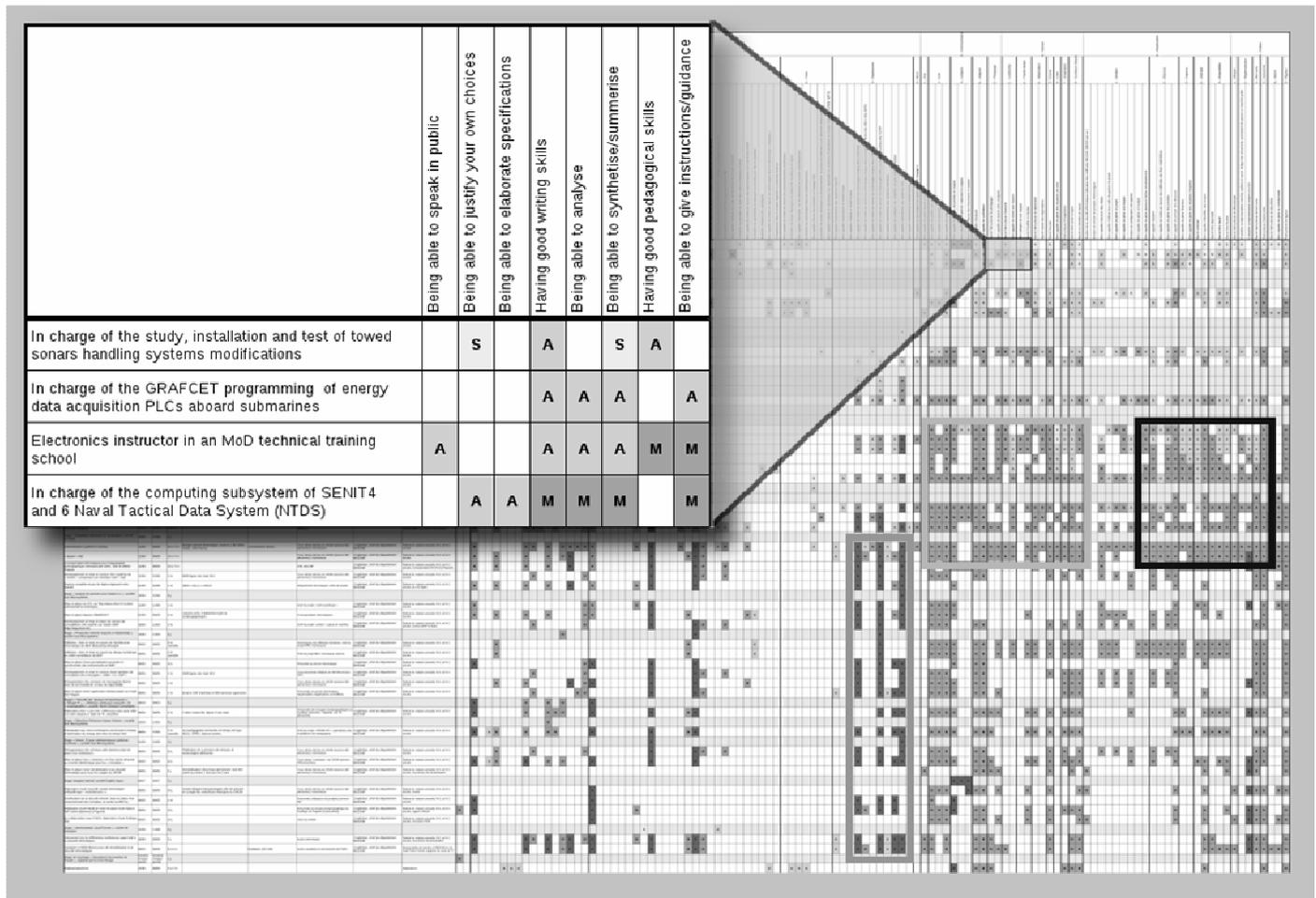


Figure 1. Proficiency matrix example (courtesy of B. Treguier).

The top-down and bottom-up approaches were both used in our institution at Master of engineering degree level. Even if, so far, few candidates have followed the approaches under counseling, the experience allows us to draw preliminary results (n=2 in 2011 for a certification managed by professional bodies; n=1 in 2009 for a validation of professional and life experience to obtain a diploma). In our opinion, the syllabus is the central problem of the previous difficulties (i.e. process completion and jury requirement satisfaction). Moreover, it is hard to align educational program syllabus with vocational competency development as in companies or industries.

On the one hand, if the syllabus is simply considered as a reference model by the candidate, with all of its conceptual limits and ambiguities, a simple projection as in the first top-down approach tends to move away the candidate from his/her values, individual skill scope and expectancies. This approach, concentrated on gaining confidence in covering the main required professional activity domains, tends to limit the scope of candidate potentialities.

On the other hand, the second bottom-up approach, concentrated on reflection-on-action principles, suggests a process to guide a vocational in defining his/her competency

referential, so as to reconnect with one's skills. With such material defined, analysis and evaluation of proficiency levels could then be more objectively conducted. This process regularly questions the professional identity of the individual and supports autonomy. It is more personal and reflective. Self-efficacy and thus motivation [12] of a candidate are significantly improved during the bottom-up approach and

have been maintained over time. More precisely, candidate's beliefs to better confront new situations and contexts was enhanced. The 2009 candidate was much more self-confident and reactive during the final jury defense. Furthermore, the candidate better underpins his lifelong learning and training, and thus gains a better personal management quality of employment as action plan.

ACKNOWLEDGMENT

The author expresses his gratitude towards Bruno Treguier for his active and reflective participation to the bottom-up approach proposed in this paper. Candidate in 2009 to the Telecom Bretagne Master of engineering diploma by validation of professional and life experience, he implemented and regularly revised the impressive Fig. 1, using a spreadsheet application, all along the preparation of his final written deliverable for the jury. This essential tool for a bottom-up approach finally did not appear in the final report delivered to the jury.

REFERENCES

- [1] European Society of Association Education. "What is Lifelong Learning? The view from the European Commission", 2005.
- [2] D. Schön. "The Reflexive Practitioner", Basic Books, 1983.
- [3] ABET.Inc. "Criteria for Accrediting Engineering Programs (2010), Effective for Evaluations During the 2010-2011 Accreditation Cycle".
- [4] E. Crawley, J. Malmqvist, S. Ostlund, and D. Brodeur, D. Rethinking Engineering Education: The CDIO Approach. Springer Verlag, 286 pages, 2007. Details: <http://www.cdio.org> Accessed: November 2011.
- [5] S. Rouvrais, J. Ormrod, G. Landrac, J. Mallet, J.-M. Gilliot, A. Thépaut, and P. Tremembert. "A Mixed Project-based Learning Framework: Preparing and Developing Student Competencies in a French Grande Ecole". *EJEE European Journal of Engineering Education*, Vol. 31 (1), 2006, pp. 83-93.
- [6] D. Boud and al. "Assessment 2020: Seven Propositions for Assessment Reform in Higher Education," Australian Learning and Teaching Council, 2010.
- [7] T. Hussey and P. Smith. "The Uses of Learning Outcomes", *Teaching in Higher Education Journal*. Vol. 8 (3), 2003, pp. 357-368.
- [8] J. Biggs. "Enhancing Teaching through Constructive Alignment," *Higher Education*, 32, 1996, 347-363.
- [9] S. Rouvrais and V. Chiprianov. "Modeling and Architecting Educational Frameworks," in Electronic Proceedings of the 7th International CDIO Conference, Technical University of Denmark, Copenhagen, 2010, June 20-23.
- [10] B.S. Bloom, M.D. Englehart, E.J. Furst, W.H. Hill, and D.R.. Krathwohl. *Taxonomy of Educational Objectives: Handbook I- Cognitive Domain*. New York: McKay, 1956.
- [11] S. Rouvrais and N. Chelin. "Engineer Professional Identity: For an Early Clarification of Student's Perceptions," in Electronic Proceedings of the 6th International CDIO Conference, École Polytechnique, Montréal, June 15-18, 2010.
- [12] B.J. Zimmerman. "Investigating Self-Regulation and Motivation: Historical Background, Methodological Developments, and Future Prospects". *American Educational Research Journal*, Vol. 45, No. 1, 2008, pp. 166-183.