A competency-based model to bridge the gap between academic trainings and industrial trades

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***Abstract*—Within today's European socioeconomic context, supporting careers choices and occupational integration has become a major challenge. Education has to fit the changes of industry and job market, but this process requires a unified representation of professions and training programs. The competency concept appears to be a common vector, since it has turned to be a pervasive idea. Although industry has started specifying trades through competencies, similar attempts are not initiated for education yet. In this paper, we present a unifying model for training programs, professions and learners, built around competencies. Based on this model, several tools have been developed to help (1) educational teams to make sure that conceptions of curriculum fit the targeted learning objectives, (2) learners to make their careers choices through life easier, (3) industrial actors to identify training programs matching with their needs.**

Competency; training engineering; vocational guidance; learner; model-driven approach

I. INTRODUCTION

Since French universities became responsible for students' vocational guidance and social inclusion, within a socioeconomic context making the latter engage in further studies with a more professional goal, they have now to align their teaching strategies with the evolution of industry. One of the issues relates on a consistent description of training programs and professions. The notion of competency has already been used to describe either training programs or trades. However these initiatives remain independent from each other, unable to reach that goal.

In order to address this issue, we propose in this paper a unifying model based on competencies to link both academic and industrial domains with a set of tools dedicated to various actors of the academic and industrial sectors. Section 2 exposes the main reference documents that represent the basis of our model, detailed in section 3. This model is next exploited in section 4 by several tools intended to teaching teams and learners, and to professional actors as well. Finally we conclude and expose some perspectives of these works.

II. STATE OF THE ART

Through our model, we would like to reach the following objectives: teaching teams must be able to describe trainings from a conceptual point of view and then implement the matching organization(s) with the guarantee of the consistence, and be able to adapt their programs to the changes of the industrial area. Learners must be able to (1) easily select their courses according to their professional goals and profile, (2) self-evaluate according to their projects, and (3) easily identify academic accreditations they could acquire by the validation of their acquired experience. Finally, professional actors must be able to identify a training supply according to their needs.

The need to use a unique description of competencies brings to the use of reference documents, like the European e-Competence Framework (e-CF) or the Certificate in Internet and Information Systems (C2i). While they suffer from a lack of precision needed to give our model a good analytical potential (e.g.: e-CF uses knowledge, skills and attitudes to compose a competency, but only as a non exhaustive list of examples), they are already used in some other reference documents to describe professions, like the European ICT Professional Profiles from the ECN (European Committee for Standardization) or the RH 2011 document from the CIGREF (Network for large French companies), these documents becoming widely used in companies.

The Course Description Metadata (CDM) and the European standard, the Metadata for Learning Opportunities (MLO) are both used in Europe to describe a training program (TP). However, they do not provide a structure to describe a curriculum according to the competencies it involves, and they both stick to an administrative structuration of the TP, thus are unable to express its conceptual view only, focusing on the learning objectives.

Finally, we need to include the learner profile within our model. Some initiatives like [1] have proposed such profiles which take into account competencies, however they tend to express competencies as a simple expression and cannot ensure the link to TP or professions. We have then chosen to extend the model we proposed in [2] : an open learner profile compliant with well-known standards such as IMS LIP (Learner Information Package), IEEE PAPI (Public And Private Information) or W3C FOAF (Friend Of A Friend).

III. THE UNIFYING MODEL

This model illustrated in Figure 1 can be divided in 5 sub-models: the competencies sub-model (top right part), acting as a hub unifying through different semantic links professions (top part), conceptual description of TP (bottom right part), and learner profile (left part). A last sub-model is the organizational description of TP (bottom left part).

Competencies, professions and conceptual description of TP are related to their corresponding framework, to facilitate management of reference documents. Moreover,

organizational and conceptual views of a TP are split. It enables the expression for some TPs of a common set of learning objectives, while each of them has its own organization, but also brings to the possibility of a top-down approach to built a TP, from the structuration of its different learning outcomes around competencies, to the design of learning paths to reach them, within a certain organization.

With the different links between TP and competencies, we can express the mobilization or certification in a learning outcome of some competency levels. The associations with the learner's profiles also provide different semantics like the certification he gained, the competencies he mobilized in other experiences or the jobs he is targeting.

This competency-based model, characterized by a generic structure, a precision of description that makes it reusable in different contexts of training and industry, provides the ability to reach the goals we defined lately.

IV. THE EXPLOITATION TOOLS

Based on this model, we developed a set of tools integrated within a web platform (http://vegas.univ-tlse3.fr/Competences-web), and entered different frames of reference related to ICT: the e-CF and C2i2mi (C2i for ICT professions) for the competencies, the ICT Professional Profiles and the RH 2011 for the trades, and the frame of reference Miage for the trainings (a formation for computing methods applied to organizations management, dispensed in 20 universities). The platform covers the objectives mentioned previously, by offering several application to educational designers, learners and professionals.

For instance, one of these tools enables the design of a TP in the top-bottom approach explained previously, checking the consistence all along the creation process. Also, two others target the learner. A recommender selects the best TP according the learner's profile (in term of competencies and targeted jobs), while a personalized visualization map for their current training program gives a view of their progression through the development of competencies related their professional goals and highlights the competencies (and thus, the learning units which mobilizes them) they should focus the most.

The tools exposed in this section have been presented to various academic institutions and professional organizations, including the 20 Miage training teams, the university of Bordeaux, and the CIGREF; great interest and enthusiasm have been shown regarding our approach. The Miage teams now use our tools to facilitate the harmonization of the pedagogical objectives, and an experiment involving learners of this TP have been launched at the beginning of the year.

V. CONCLUSION AND PERSPECTIVES

We suggested in this paper a model-driven approach based on competency to unify representations of trainings, professions and learners. Our model integrates the well-known standards, while taking into account the reference documents and models related to competencies and professions. The different tools we developed address some facilitation objectives, from the design and identification of

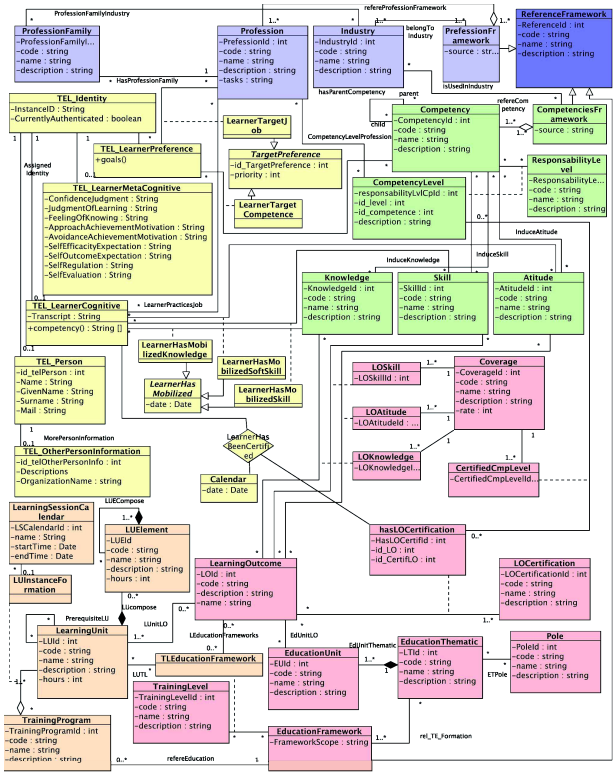

Figure 1. The unifying model around competencies

training programs, to the lifelong orientation of learners, and demonstrate the usability of our model and its capacity to meet heterogeneous needs.

An important barrier in our work is the highly dynamic characteristic of the learner's profiles, which must be permanently updated. Some works are in progress to deduce the level of acquisition of a competency; the works led by the Technology-Enhanced Learning communities, both in Education and Computer Sciences, have to be studied to address this issue of competency evaluation [3]. In addition, perspectives are worth considering, such as the automatic deployment of training activities, starting from the training design tool presented in this paper. We need to propose a finer level of granularity that includes the description of learning activities. Such an improvement would be also pertinent for the personalization of learning paths. In this perspective, other approaches such as the use of the metacognitive learner's profile, yet undeveloped, or the data mining on the usage of the tools must also be considered.

REFERENCES

[1] B. Mascret, N. Randriamalaka, and S. Jean-Daubias, "Des profils d'apprenants au portefeuille de compétences dans un contexte de formation à distance personnalisé," presented at the TICE, 2012.

[2] T. Ramandalahy, P. Vidal, and J. Broisin, "Opening Learner Profiles across Heterogeneous Applications," presented at the 2009 Ninth IEEE ICALT, 2009, pp. 504–508.

[3] G. Paquette, "A Competency-Based Ontology for Learning Design Repositories," *International Journal of Advanced Computer Science and Applications*, vol. 5, 2014.