

OPPORTUNITIES FOR THE EUROPEAN CERTIFICATION OF THE INTEGRATED DESIGNER AND ENTREPRENEUR PROFESSIONS

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Abstract: The paper presents the European Certification and Qualification Association, the evaluation and certification procedure, and then the content of the training program for the Integrated Design Engineer and Research-Entrepreneur job roles (based on defined skills card). The Integrated Design Engineer training program is based on seven skills unit: the Reasons for Integration in Design, the Targets of Integration in Design, Essential Methods of Integration in Design, Mastering Complexity in Integrated Design, Collaborative Integrated Design, and Selected Aspects of Integration. The Research-Entrepreneur training program consists of six skills unit as: Understanding the Entrepreneurship, Shaping Ideas, Innovation Transfer, Knowledge Networking, Empowerment by Learning Organization Environments and General Subjects. The training program is based on skills unit: that have been detailed in skills elements and corresponding performance criteria. Finally, the main opportunities for Romanian are presented taking into consideration the ECQA schema and the defined training program.

1. INTRODUCTION

In the last years, European universities are confronted with the Bologna Process implementation that implies the education process reform by considering 3 cycles: license, master and PhD (doctoral studies). Each country tries to adapt this restructuring process to its own needs. In Romania, for the case of the technical high education there has been adopted a structure of the subsequent cycles 4 years bachelor studies – 2 years of master studies – 3 years of PhD. program and there have been defined the domains (fields) and corresponding specialization. These were analyzed and certified by the National Council for Academic Evaluation and Accreditation (CNEAA) and the education processes quality evaluation. The qualification certification has been evaluated, recognized by the Romanian Agency for Quality Assurance in High Education (ARACIS, www.aracis.ro) and the National Agency for the High Education Qualification and Partnership with the Economic and Social Environment (ACPART).

In Europe there exist many evaluation, qualification and certification bodies. One of them is the European Certification and Qualification Association [4, 10], and Politehnica University of Timisoara is a member of this association. Integrated Design Engineer and EU Research-Entrepreneur are new professions certify by ECQA, as a result of two Leonardo da Vinci project that join together specialists from EMIRAcle - European Manufacturing and Innovation Research Association a cluster leading excellence [3] and other training bodies in Europe [12].

The paper will briefly present: the ECQA, the evaluation and certification procedure, and then the content of the designed training programs for the qualification and certification of two job roles: the Integrated Design Engineer and EU Research-Entrepreneur as a result of our cooperation in the iDesigner and ResEUr projects.

2. EUROPEAN CERTIFICATION AND QUALIFICATION ASSOCIATION ROLE

The ECQA is the result of a number of EU supported initiatives in the last ten years where in the EU Life Long Learning Program different educational developers decided to follow a joint process for the persons from industry certification. Through the ECQA it becomes possible to attend courses for a specific profession in one country and perform an Europe-wide agreed test at the end of the course. The certificate will be recognized by European training organizations and institutions in 18 member countries. European work forces are highly flexible and need to work for industries across Europe. For example, participants might be attending a course in one country and perform and pass the exam at the end of the course. The certificate will afterwards be recognized by ECQA certifiers and training organizations in all European countries (e.g.: France, Germany, Spain, Italy, Scandinavian countries, all Eastern European countries etc.) participating in ECQA. This will automatically lead to a higher recognition of the certificate and higher chances of working for customers in an open European market [4, 9].

The following professions are currently supported by the European Certification and Qualification Association: Configuration and Change Manager, e-Business Manager, e-Commerce Engineer, EQ Interpersonal Skills, e-Security Manager, EU Internal Financial Control Assessor, EU Project Manager, Information and Communication Engineer, Innovation Manager, IT Consultant for SMEs, Professional for IT - Security Management, Professional Competences, SCOPE Manager, SPI Manager, SW Architect, SW Project Manager, Governance SPICE Assessor, *Integrated Designer*, *Research-Entrepreneur*, Incubation Manager, E-Learning Manager, Interpersonal Skills, Terminology Manager. The implemented learning and course development system is represented in figure 1 [4, 9, 10].

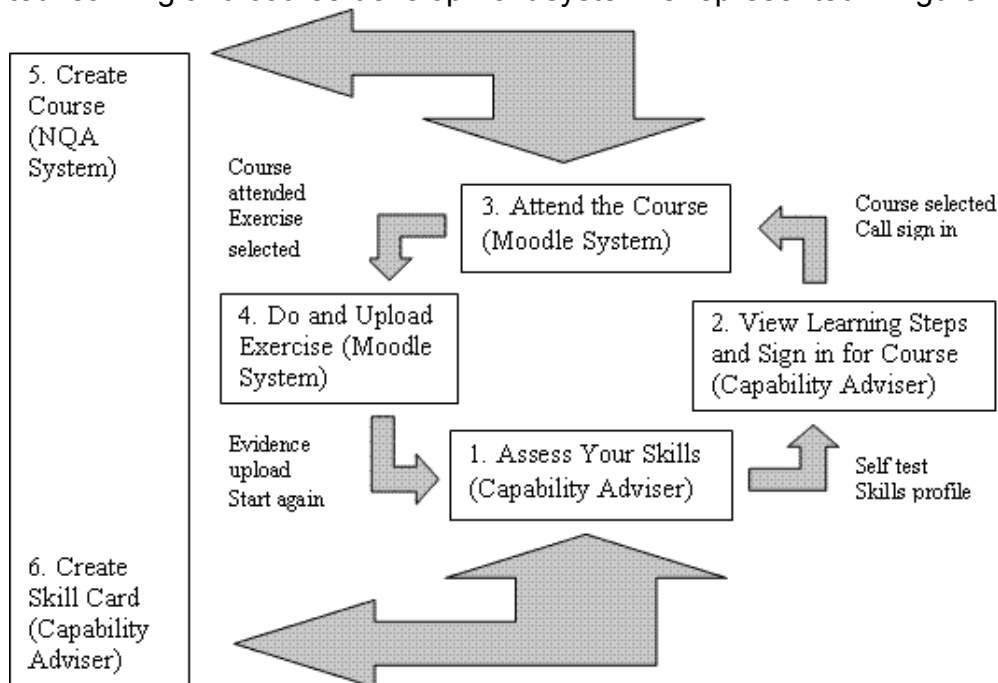


Figure 1. The Implemented Learning and Course Development System

What are the aims of the Association?

(1) ECQA activities provide the organization for certification and accreditation of new job roles (professions), training organizations, trainers and examination bodies and the co-operation of those entities on a regional, national and international level, in order to: (a) Foster the accreditation, update and release of new job roles (professions) to be accepted into the job pool to achieve a higher qualification in the international labor market using an

accreditation, test and certification system; (b) Support regional and/or transnational skills assessment and testing by using an accreditation portal for Europe; (c) Provide the backbone for the accreditation of training organizations, trainers, examination bodies and certificate issuance for all members.

(2) ECAQ promotes and supports the certification and accreditation process of job roles for businesses and higher education institutions on a regional, national, and transnational level.

(3) ECQA supports and validates new developments within the member network and beyond.

(4) The running of the skills assessment, test and accreditation portal for certification and examination bodies will lead to a higher level of trainings and trainers and better qualification of participants in Europe.

(5) The experiences will also be disseminated amongst other European partners. Especially individual trainees will benefit from the outcome of the activities.

„Politehnica” University of Timisoara is the training provider on the Certified Integrated Designer profession in Romania.

The Implemented Learning - User level: Learner

1. Participants (Learners) log into the Capability Adviser, browse the skills tree, assess their skills against performance criteria, upload evidences to prove their skills, and print a skills profile.

2. Participants (Learners) select the “Learning Steps” option the Capability Adviser, access recommended learning references, and can call “Sign In” to log into courses on the Moodle web based training server system.

3. Users (Learners) on the Moodle System, attend the courses, perform exercises, upload homework results, and receive feedback from the trainer.

4. Users (Learners) switch to the Capability Adviser window (if you did all in one session) or log into Capability adviser as participant and upload their homework results as evidence into the system to prove their competence.

The Implemented Accreditation Process - User level: Assessor/Accreditation Body:

5. Users (Learners) inform Assessors. Formal Assessors log into the Capability Adviser, assess the evidences, assess the performance criteria, and produce a formal skills profile of the user. The results of the formal assessor display separately.

The Implemented Course and Skills Development System - User level: Course and Skills Developer/ Administrator - Course Developers (Trainers, Accreditation Institutions, etc.) log into an e-working space where course material development work can be shared in a team. The system offers team management, working scenarios, version control, and an interface to:

6. Export the training and reference materials in the Moodle based training system.

7. Enter and administer a skill card online, which forms the basis for step 1 in Figure 1.

3. INTEGRATED DESIGN TRAINING PROGRAM

Figure 2 shows the skill set/card knowledge map which provides the basis of our development activities. It is the consolidation result of our research experiences, in education, and in collaboration with industry [8, 13, 14, 15]. Each skill unit will be briefly presented in the following.

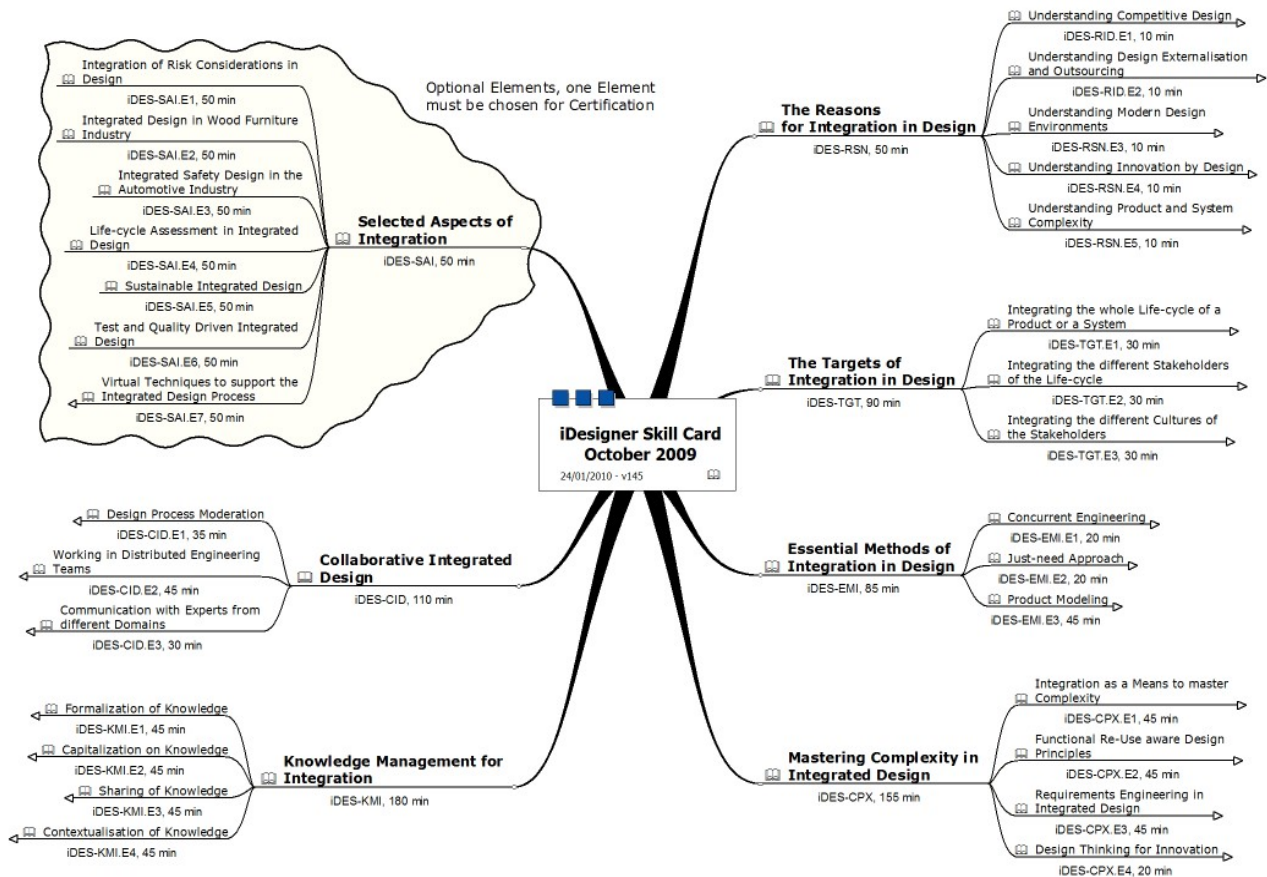


Figure 2. The Skills Card of the iDesigner Qualification and Certification Program

1 The Reasons for Integration in Design unit deals with the motivation for the paradigm of Integrated Design by [16]:

- a) *Understanding Competitive Design* - The element describes the key importance of design for creating products that are competitive on increasingly global and fast-evolving markets;
- b) *Understanding Design Externalization and Outsourcing* element focuses on the reasons for the need of design tasks externalization and outsourcing, and gives an overview of the competence requirements implications;
- c) *Understanding Modern Design Environments* have to support the key aspects of integrated design, which are essentially centered on the support of the collaboration and knowledge sharing of experts from different domains during the design tasks.
- d) *Understanding Innovation by Design* element focuses on the importance of design to innovate products. Integrated Designers have to be able to collect and implement requirements of all the stakeholders into the product;
- e) *Understanding Product and System Complexity* element deals with the notion of complexity in the context of modern products. It highlights different definitions and means to measure complexity.

2 The Targets of Integration in Design:

- a) *Integrating the whole Life-cycle of a Product or a System* element deals with concept as product life-cycles with the target to establish the basis for understanding the variety/complexity of requirements on integration activities and the way of integration thinking in integrated design activities;
- b) *Integrating the different Stakeholders of the Life-cycle* target is thus to identify the most typical and important stakeholders of the product life-cycle, their potential roles, functions

and influences with respect to the product. The goal for the Integrated Design Engineer is to be able to identify as completely as possible all potential sources of requirements to the product design;

c) *Integrating the different Cultures of the Stakeholders* element points out this need and gives an overview of relevant key issues.

3 Essential Methods of Integration in Design unit deals with:

a) *Concurrent Engineering* method is still a relatively new design management system, but has had the opportunity to mature in recent years to become a well-defined systems approach towards optimizing engineering design cycles. Because of this, concurrent engineering has garnered much attention from industry and has been implemented in a multitude of companies, organizations and universities [16];

b) *Just-need Approach* element deals with concepts and examples about this approach, as well as with tools that help apply it;

c) *Product Modeling* is element looks at different modern approaches to product modeling, as well as modeling tools and languages.

4 Mastering Complexity in Integrated Design unit focuses on:

a) *Integration as a Means to master Complexity* is a key factor of Systems Engineering;

b) *Functional Re-Use aware Design Principles* element teach student about typical generic re-use and platform centered architectural design strategies;

c) *Requirements Engineering in Integrated Design* element teaches Requirements Management principles inspired by the discipline where it is considered to be most maturely developed: Software Engineering [1, 13, 15];

d) *Design Thinking for Innovation* element conveys the elements of this essential method, which aims at maximizing the creativity of designers while making them consequently, respect the requirements and constraints imposed by the life-cycle the product or system is supposed to run through.

5 Knowledge Management for Integration unit explain [1, 16]:

a) *Formalization of Knowledge* learning element teaches ways that lead to the formalization of knowledge, which is the necessary basis for knowledge capitalization and sharing;

b) *Capitalization on Knowledge* element seeks to qualify Integrated Designers to capitalize on knowledge acquired in certain domains, for design tasks on other domains, as well as for variants in the same domains;

c) *Sharing of Knowledge* element deals with knowledge Sharing methods, tools and its advantages for the individual designers and the whole organization;

d) *Contextualization of Knowledge* element points out the key issues for the contextualization of knowledge.

6 Collaborative Integrated Design unit deals with [2, 14, 15]:

a) *Design Process Moderation* element the student learns about the particularities of the moderation process in the case of the integrated engineering process:

b) *Working in Distributed Engineering Teams* skill element is dedicated to the human working interactions training. The focus is on obtaining efficiency and effectiveness in the design team;

c) *Communication with Experts from different Domains* learning element the student learns about the particularities of the communication in distributed engineering teams that are typically composed of experts from several different domains.

7 Selected Aspects of Integration unit teaches:

a) *Integration of Risk Considerations in Design* - This element teaches principles about the systematic integration of risk considerations in the design of products and systems;

- b) *Integrated Design in Wood Furniture Industry* - This is a case study of cooperative integrated design in the wood furniture industry, which points out as a key success factor the systematic integration of different experts during the early product development phases;
- c) *Integrated Safety Design in the Automotive Industry* element studies the key competences required to integrate safety considerations systematically into product and system design. It is focused on automotive embedded systems;
- d) *Life-cycle Assessment in Integrated Design* learning element focuses on the systematic impact assessment throughout the product life-cycle during the design phase;
- e) *Sustainable Integrated Design* element focuses on the consideration of sustainability factors in terms of environmental, economical and societal aspects;
- f) *Test and Quality Driven Integrated Design* element deals with key issues about designing products with testability and quality assurance in mind all along the development process;
- g) *Virtual Techniques to support the Integrated Design Process* element discusses some selected virtual technologies which designers are typically confronted with in modern design environments, and which integrated designers are supposed to be able to capitalize on.

4. THE RESEARCH-ENTREPRENEUR TRAINING PROGRAM

The qualification and certification of Research-Entrepreneur aimed for experienced researchers (young researchers, PhD students from universities or industrial organizations), master students (of different specializations as industrial engineering and management) who want to complement and/or certify their advanced entrepreneurial skills. The target group students typically have availability and abilities for developing an entrepreneurship behavior (creativity, innovative initiatives etc.). The certificate, however, is supposed for certification of the target group of student's capabilities as future entrepreneurs and/or to develop their entrepreneurial behavior [5, 6, 7].

One of the biggest challenges is to develop a training program that covers the complete skills set that better comply with the target group specific needs. As a preliminary research, each partner involved in the ResEUr project, has identified his target group and its specific needs (a number of unstructured interviews were done with potential students and also, with other companies and organizations that deliver training programs for entrepreneurs; preliminary observation of the local market specific). During some virtual project meetings the working procedure of ResEUr project team were agreed. It has been implemented for the development of the skills card based on the information gathered in target group research.

Figure 2 shows a knowledge map of the skill set which provides the basis of our research and development activities of ResEUr partners. It is the result of an initial consolidation of our experiences in research, education, as well as in collaboration with industrial partners, and other business organizations (e.g. Chamber of Commerce, students' organizations, clusters in the business environment etc.). Although we consider this skill set already stable. Later in the project, it is supposed to evolve in the implementation stage of the project when feedback from partners in industry (from employees of the research and development departments), from academic staff, from students of initial training seminars [2, 11] and from experts of different research sectors.

As it can be seen in Figure 2, the skill card is represented by a map (using the MindManager software). The main branches represent the skill units and the second levels of branches correspond to skill elements. Under each skill unit and element there are indicated: the specific code, the partner acronym that will develop the correspondent

training material, and the estimated duration of the training. The branches on the third level are allocated to the performance criteria of each element (that are in direct relation with the questions that shall be defined for the examination process related to the certification of the job role) [4].

This representation of the skill card allowed an optimal visualization of the whole developed work (in different project stages) and also, the harmonization and integration of the partners for attending the project objectives. The skill set map was a good tool of communication between the partners and the IT specialists involved in the project, too. The content of each skill unit defined in the ResEUr project is briefly described below.

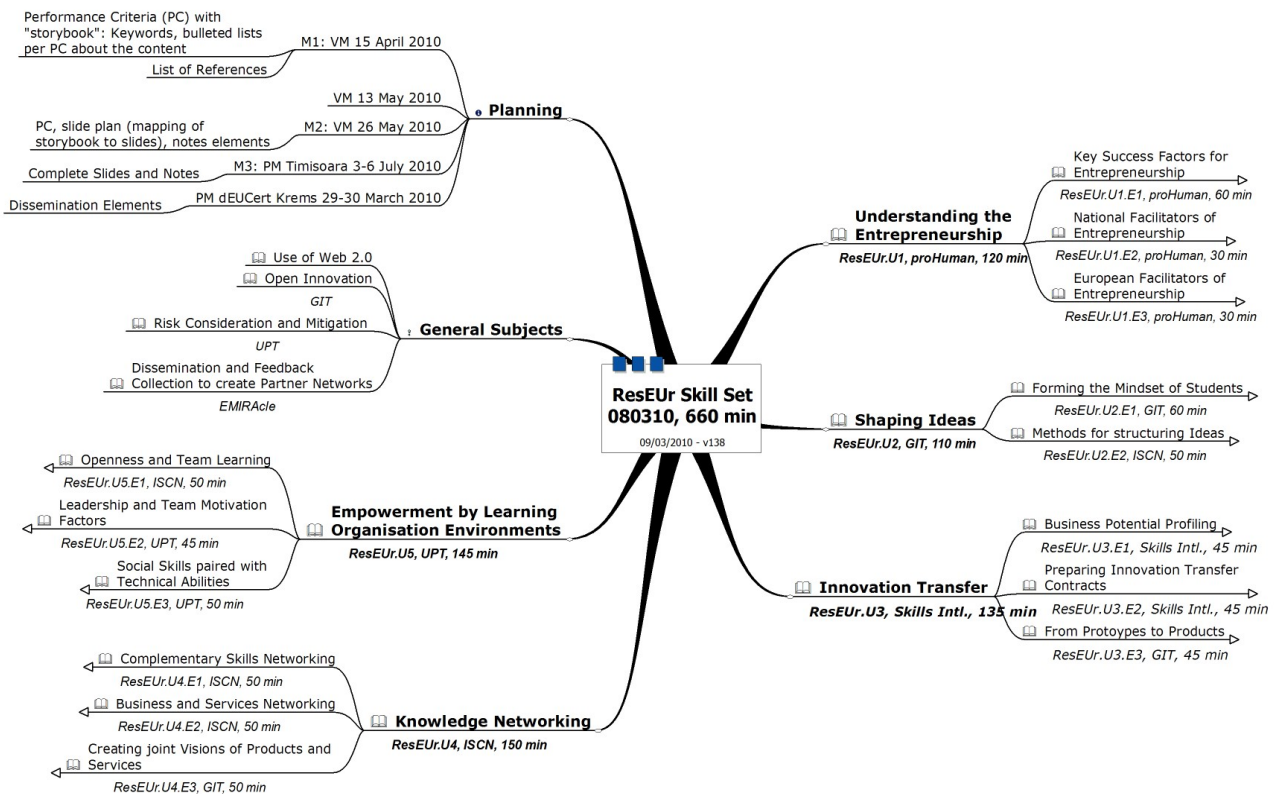


Figure 2. The ResEUr Skill Set Map

1 Understanding the Entrepreneurship unit provides highly condensed and concise information about key issues of entrepreneurship, which are typically taught in seminars which are currently offered by various institutions. The unit, however, does not want to replace such seminars and courses, but it rather seeks to give the student a convenient means of thinking on whether she/he needs formation in the respective competence areas, and where she/he can find complementary courses. The unit consists of the following elements: key success factors for entrepreneurship; national facilitators of entrepreneurship; European facilitators of entrepreneurship. This unit will be developed with the contribution of all partners because of the specificity of the entrepreneurship support at the national level [5, 6, 7].

2 Shaping Ideas unit deals with key skills that are required to leverage brilliant ideas, starting from creating an innovative mindset in students' heads, passing via methods for structuring ideas, and ending by discussing methods and best practices for presenting ideas. The unit consists of the following elements: forming the mindset of students; methods for structuring ideas.

3 Innovation Transfer unit focuses on issues concerned with the transfer of innovation from the academic environment to the competitive market. These issues are known to represent key success factors of entrepreneurship in the academic domain. The unit consists of the following elements: business potential profiling; preparing innovation transfer contracts; from prototypes to products.

4 In the ResEUr qualification, **Knowledge Networking** is considered the core competence area for entrepreneurs. Networking knowledge from several different domains and sectors can create the decisive competitive advantage of modern and future-oriented enterprises. The unit highlights several significant factors of this networking paradigm with special relevance for enterprise creators in the academic domain. The unit consists of the following elements: complementary skills networking; business and services networking; creating joint visions of products and services.

5 Empowerment by Learning Organization Environments unit puts the concept of the Learning Organization in the middle of the successful enterprise creation and of an entrepreneurial behavior. In this context the skill elements are: openness and team learning; leadership and team motivation factors; social skills paired with technical abilities.

6 General Subjects skill unit is dedicated to some specific subjects (skill elements definition) as: use of Web 2.0; open innovation; risk consideration and mitigation.

With this brief overview about the skills units and the correspondent skill elements we have defined the training materials domains. Also, the performance criteria associated with each skill element shows the content of the training materials. Taking into consideration the suggested structure of the skill card it is easy to imagine the structure of the e-learning platform.

5. CONCLUSIONS

The paper is presenting the ECQA schema and its functionalities for the certification of different professions in Europe. Integrated Design Engineer and Research-Entrepreneur are new professions being developed to be offered within ECQA certification schema. The ECQA standardized learning and course development procedures can easily be used (Moodle platform for learning and examination) by business, industrial and academic users (students, trainers, course developer) [4, 10].

The described Integrated Designer training program is based on *7 skill units*: the Reasons for Integration in Design, the Targets of Integration in Design, Essential Methods of Integration in Design, Mastering Complexity in Integrated Design, Collaborative Integrated Design, and Selected Aspects of Integration. These skill units have been detailed in skill elements and corresponding performance criteria. The presented structure and the content of the training program is the result of many virtual meetings and project meetings of the specialists involved in the iDesigner project. The certification procedure allows total and partial certificates. The competencies planned to be trained are complementary to general master programs in the field of manufacturing or design engineering.

The described Research-Entrepreneur skill card definition (skill units, elements and performance criteria) will be used for the training materials development. The Research-Entrepreneur training program, as a preliminary result of the ResEUr project, consists of 6 skill units as: Understanding the Entrepreneurship, Shaping Ideas, Innovation Transfer, Knowledge Networking, Empowerment by Learning Organization Environments and General Subjects. The competencies planned to be trained are complementary to general master programs in the field of engineering and management.

The described approach is a classical one for skill set provision on the ECQA platform. The *main opportunities* from the European certification of the Integrated Designer and Research-Entrepreneur job roles in the case of Romanian are:

(1) It offers the possibility for obtaining an EU certificate (total or partial) for the students that follow the training program and pass the examination process successfully (more than 66.7% of the answers are correct) together with the master diploma. This certificate offers them complementary competencies, compatible on the EU labor market (e.g. students can be easily integrated themselves in multinational companies in Romania or in other companies in Europe [3]. Also, students will be encouraged for developing their own business as results of their implication in research activities; e.g. spin-offs). This opportunity can be attractive for the PhD. students and young researchers, too [6, 7, 11];

(2) This qualification and certification opportunity can be used by the engineers employed in industrial companies that want to update and develop their knowledge in the integrated design field for better aligning themselves to the new trends (new processes and new requirements). The research-entrepreneur qualification and certification program can be also, attractive for people (employees or unemployed) that have innovative idea and want to become entrepreneurs [5, 6, 7];

(3) The different skill units of the training program can be introduced in some master program courses (in their syllabus) and in this way, students can be trained for successful certification. Professors from academia can become ECQA trainers for iDesigner and ResEUr professions. A very successful sample of such schema is implemented for ECQA Certified EU Project Management at the University of Maribor, Slovenia and University of Rijeka, Croatia [19];

(4) The Romanian master programs in the field of industrial and manufacturing engineering and also, in the field of engineering and management can obtain an European dimension and they can be more attractive for the potential students [17, 18];

(5) Universities or other training bodies can become collaborators of the ECQA and they can benefit from the established schema and experience gained.

The dissemination plan of the iDesigner training program will be implemented and tested first through the National Research Network for Integrated Product and Process Engineering (INPRO) with the implication of the master students from the universities: Timisoara, Bucharest, Sibiu, Brasov, Iasi, Bacau, Suceava and Oradea by using the video-conference system's facilities established between the universities. Also, the ResEUr dissemination plan will be implemented in the Economics-Engineering Romanian Consortium that joins together the engineering management departments.

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- Certified Integrated Designer – iDesigner (Leonardo da Vinci contract LLP-LdV-TOI-2008-FR-117025) [8];
- Certified EU Researcher–Entrepreneur - ResEUr (Leonardo da Vinci contract 503021-LLP-1-2009-1-BE-LEONARDO-LMP) [12].

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6. REFERENCES

- [1] Bernard, A. & Tichkiewitch, S.: *Methods and Tools for Effective Knowledge Life-Cycle-Management*, Springer-Verlag Berlin Heidelberg (2008)
- [2] Draghici, A., Draghici, G.: *New business requirements in the knowledge-based society*. In Cunha M. M., Cortes B. C., Putnik G. D. (Eds.), *Adaptive Technologies and Business Integration: Social, Managerial and Organizational Dimensions*. USA: Idea Group Publishing, Information Science Publishing, IRM Press, CyberTech Publishing and Idea Group Reference, 2111-243 (2006)

- [3] Draghici, G.; Draghici, A.; Riel, A.; Tichkiewitch, S. & Messnarz, R.: European Certification of the Integrated Design Engineer, Proceedings of the 6th International Conference on the Management of Technological Changes, vol.2, pp. 239-242, Alexandroupolis, September 2009, Democritus University of Thrace, Greece (2009)
- [4] ECQA (2000). European Certification and Qualification Association, *Available from:* <http://www.ecqa.org>, Accessed: 16/04/2010 (2010)
- [5] European Commission: Helping to Create an Entrepreneurial Culture – A Guide on Good Practice in Promoting Entrepreneurial Attitudes and Skills through Education (2008) http://europa.eu.int/comm/enterprise/entrepreneurship/support_measures/training_education/index.htm.
- [6] European Commission: Directorate-General for Enterprise and Industry: Entrepreneurship in Higher Education, Especially Within Non-Business Studies. Final Report of the Expert Group. (2008), http://europa.eu.int/comm/enterprise/entrepreneurship/support_measures/index.htm
- [7] Entrepreneurship in Europe, <http://www.euractiv.com/en/innovation/entrepreneurship-europe/article-117477>, (update: 29 January 2010)
- [8] iDesigner (2009). Certified Integrated Design Engineer, Leonardo da Vinci project/contract LLP-LdV-TOI-2008-FR-117025, Available from: <http://ecqa.org/index.php?id=47>, Accessed: 16/04/2010
- [9] Messnarz, R., et. al.: Assessment Based Learning Centers. Proceedings of the EuroSPI 2006 Conference, Joensuu, Finland, (2006), also published in Wiley SPIP Proceeding in June (2007)
- [10] Messnarz, R., et al.: The EQN Guide. Graz, Austria (2008)
- [11] Monitor Group, Path to Prosperity – Promoting Entrepreneurship in the 21st Century. Technical Report (2009)
- [12] ResEUr : Certified EU Researcher – Entrepreneur. Lifelong Learning Programme, Leonardo da Vinc. Contr. no. 503021-LLP-1-2009-1-BE-LEONARDO-LMP (2009)
- [13] Riel, A.: EU Certificates and Knowledge Communities in Europe: An unbeatable Symbiosis. Keynote at EQN Founding and Dissemination Conference, Krems, Austria, CD-ROM (2006)
- [14] Riel A.; Tichkiewitch S.; Grajewski D.; Weiss Z.; Draghici A.; Draghici G. & Messnarz R.: Qualification and Certification of Life Cycle Engineering Skills of Design Engineers, Proceedings of the 16th CIRP International Conference on Life Cycle Engineering LCE 2009, CD-ROM, May 2009, Cairo, Egypt (2009)
- [15] Riel A.; Tichkiewitch S.; Grajewski D.; Weiss Z.; Draghici A.; Draghici G. & Messnarz R. (2009). Formation and Certification of Integrated Design Engineering Skills, *Proceedings of the 17th International Conference in Engineering Design (ICED'09)*, Vol. 10, Design Education and Lifelong Learning. The Design Society, pp. 161-170, Stanford University, August 2009, Stanford, CA, USA
- [16] Tichkiewitch, S. & Brissaud, D.: Tools for Co-operative and Integrated Design, Kluwer Academic Publishers (2004)
- [17] Tornatzky, G., et al.: Innovation U: New University Role in Knowledge Economy. Southern Growth Policy Board, USA (2002)
- [18] Tracona, A.: Entrepreneurship Development – Key Issues and Challenges. Presentation at: CEEMAN Forum on Executive Education Executive Education and Entrepreneurship Development, Trieste, November 26-27, (2009), <http://www.vlnmedia.net/ceeman/>
- [19] Vajde-Horvat R., and Smolcic-Jurdana D. (2009) EU Project management – challenges and aspects, Slovenia.