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► **To cite this version:**

Mircea Giurgiu. Competencies in virtual collaboration applied for students'online project management under industry conditions - the case of POOL. 3rd Balkan Region Conference on Engineering Education, 2005, Sibiu, Romania. pp.38 - 41. hal-00190161

HAL Id: hal-00190161

<https://telearn.archives-ouvertes.fr/hal-00190161>

Submitted on 23 Nov 2007

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Competencies in virtual collaboration applied for students' online project management under industry conditions – the case of POOL^(*)

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ABSTRACT: This paper presents the results of a research survey for the identification of the competency profile required to train engineering students in online project management under industry conditions and in the frame of a multinational cooperation. The complexity and the innovation of this approach consists in the enhancing existing project management practices in initial university-level education and in combining technical skills with soft skills training in a distributed environment that considers the needs of the labour market. The required competencies have been identified in the context of the application of virtual group collaboration and role modelling for innovative training, thus contributing to the paradigm shift in modern industry project scenarios. The training profile is a multidimensional one, considering the structuring of the competencies in the following classes: virtual collaboration, project planning and time management, online communication, project documentation and intercultural communication. Starting from these types of competencies, the curriculum and the training handbook will be developed in the near future. The activities are taking place in the frame of the Leonardo da Vinci pilot project POOL: "Project Organisation OnLine as a model of equipping engineering students with team-working and communicative competencies in a multinational setting using ICT".

INTRODUCTION IN THE POOL PROJECT

One of the key-components in preparing students for the demands of the labour market is the project-based training. Nevertheless it is true and commonly agreed by personnel managers and recruiting agencies that team-working and problem-solving skills as well as communicative competence vitally contribute to the employability of university graduates [1]. Such developments are not yet well integrated in the curricula of the educational institutions. This raises relevant questions that need to be addressed if students should be adequately prepared to meet the challenges in their future workplaces, where international collaboration in a distributed setting has become the norm [2][3].

The POOL („Project Organisation OnLine as a model of equipping engineering students with team-working and communicative competencies in a multinational setting using ICT") project undertakes to address these questions in a European context and provide a model for integrating distributed project management training into engineering curricula:

- What aspects need to be considered when preparing students to work in multinational online teams?
- What European consensus can be achieved across national borders with respect to online project organisation, documentation and quality control?
- What areas provide difficulties and why?
- What industry and real working life demands can be reflected in project training to ideally prepare students for the labour market?

The unique approach trialled in this project is the combination of a real-life university-industry project in combination with the critical reflection and evaluation of the curriculum. Theory and industry practice are thus synergetically utilised to achieve the most efficient and effective form of training for the engineering students. The student project serves as the touchstone for all questions to be addressed and considered. All communication as well as documentation is carried out in a Virtual Learning Environment (VLE) that will enhance awareness of the sensitive issues involved in online project collaboration.

EC curriculum guidelines [4] emphasise the "... broad systems perspective ... training in team working, with real experience of team projects where several activities are undertaken in parallel, good personal skills such as problem solving abilities, and awareness of cultural differences when acting in a global environment." This definitely calls for a reconsideration of the communicative and organisational framework in industry projects as well as the didactic and methodological approaches in the training in accordance with the curriculum guidelines. Whereas project-based learning has been widely accepted as a core methodology in initial university engineering education, its focus has mainly been on the acquisition of technical skills and has not fully considered the complex interplay of communicative, organisational and domain-specific aspects. This skills deficit is even more evident in a distributed and transnational setting, where communication is a crucial success factor.

The POOL project aims to achieve the following objectives:

- to provide a curriculum model for integrating practical project work into engineering curricula at university-level education using distance education

- to best prepare students to work in multi-skills and multinational teams in a distributed setting
- to filter out and agree on a set of quality criteria for online project management training in university-level education based on current industry practices and taking into account expected future developments
- to compare and evaluate practised national vocational/professional requirements/standards for project organisation and management in a distributed environment using distance education
- to (re)assess the role of high-level academic education in preparing engineering students for professional project and team work
- to (re)evaluate the curriculum development process through the active involvement of and dialogue between university-students-industry
- to use and evaluate distance education and electronic communication in skills acquisition and knowledge building

THE PEDAGOGICAL APPROACH FOR CURRICULUM

The POOL project departs from existing curricula and industry projects carried out in the framework of university-level education and builds on the practices and expertise of its consortium partners. It acknowledges the feedback from industry partners and real-life workplace scenarios where project team work often involves transnational and virtual elements. It therefore extends current project management training by a transnational and a virtual component. The challenge lies in the integration of these new aspects into curriculum design so that the created modules reflect current industry practices and standards as well as future developments. This raises a number of issues that need to be addressed and evaluated in the conception of training modules [6][7]. The innovative methodological and didactic approach lies in the integration of practical and theoretical considerations utilising new forms of learning for hands-on-training and involving all affected stakeholders as reflected in the following aspects:

- i) the active involvement of the primary beneficiaries, the students and industry partners in curriculum development
- ii) the interaction of university-industry as a new model for knowledge transfer into the industry
- iii) the utilisation of forms of online learning and teaching in a distributed project environment
- iv) the combination with the practical field-trial of online project management in a real-life student-industry project:
- v) the consideration of advanced didactic and pedagogical methods: state-of-the art expertise on online projects as well as distance education are assessed and taken into account.

The underlying didactic methodology conforms to the latest developments that have been especially relevant for any online training. These include:

- adopting a moderate constructivist approach acknowledging learner learner self-organisation
- providing stimulating learning situations considering the specific constrains/ potentials of the online medium
- selecting a learner-centred organisational and communicative framework that enhances motivation
- adopting a blended learning approach that will utilise both online and offline scenarios to their full potentials.

The curriculum design will use a skills-based approach to accommodate the special focus on work-orientation.

More specifically, competency profiles are based on real-life tasks and reflect current work practices. The consultation and involvement of industry partners at the early stage of the needs analysis as well as in the final evaluation phase is a major guarantor for the appropriateness of the training units. The chosen approach reflects the findings and standardized procedures as provided in the ADDIE Model (Analysis, Design, Development, Implementation, Evaluation) provided by IEEE Learning Technology Standards Committee [5]. The actual procedure is divided into the following steps:

- 1) needs analysis - the actual needs are determined and a set of job-related tasks are defined.
- 2) curriculum design - it focuses on the training approach, the definition of learning objectives and performance measures, and finally the design of a training plan
- 3) instructional development - a competency profile has been defined, which informs the creation of learning modules/units and the selection of supportive media and materials
- 4) curriculum implementation will be done in the form of university-industry student project
- 5) curriculum evaluation is based on the summative evaluation of the curriculum module testing within the pilot project and reviewed by the industry partners.

The pedagogic-didactic approach in the curriculum modules is based on quality-assured principles:

- active learner involvement
- provision of stimulating learning situations
- selecting a learner-centred organisational and communicative framework that enhances the motivation and provides the possibility for group interaction, community building and reflective learning possibilities
- blended learning approach utilises both online and offline scenarios [7].

DEFINITION OF THE COMPETENCIES FOR VIRTUAL COLLABORATION IN PROJECT MANAGEMENT

To define the competency profile required to the engineering students for online project management under industry conditions, the following training dimensions have been carefully considered:

- training for virtual collaboration
- training for project planning and time management
- training for presentation and communication
- training for electronic project documentation
- training for intercultural communication

In this paper we will present the identified competencies for virtual collaboration and for project planning. For each of them a description is given, together with three specific attributes. A more detailed description of such competencies will be given in the project handbook.

A. COMPETENCIES FOR VIRTUAL COLLABORATION

A.1. Appropriate use of Information and Communication Technologies - handling Information and Communication Technologies in complex virtual collaborative projects is a core competence that allows to automate the management processes, to develop best project-oriented practices, to facilitate the communication, sharing of ideas and better understanding and analysis of the collaborative framework:

- knowledge on ICT application in virtual collaborative environments
- skills in designing, setting-up and maintenance of technology-supported collaborative spaces
- track the project activities and identify specific patterns for virtual collaboration

A.2. *Facilitate virtual collaboration* - knowledge and skills required to understand the barriers in virtual collaboration and to create the conditions and premises for appropriate communication settings in various circumstances. Application of communication interventions and approaches to facilitate an efficient virtual collaboration.

- ability in understanding the composition of the group and the roles of each member during the whole process of a project
- prove availability for online relationships and facilitate the collaboration by exploring different communicative interventions
- know to use and to adapt communication strategies and approaches for virtual collaboration.

A.3. *Develop the project plan in a collaborative/distributed vision, maintaining professional and collegial relationships* - knowledge and skills to understand the roles, to feel as part of the group, to demonstrate the team values and to show the capacity to collaborate for the project plans agreed by all team members:

- knowledge on efficient communication and collaboration practices in virtual frameworks
- feeling of co-presence and aptitudes to engage for online communication, as part of a group
- understanding the roles of the others as a context for the own role; demonstrate team values and respect.

A.4. *Develop and share the knowledge on virtual project management* - to be able to explore ideas, to develop arguments, to know to value different sources of information and to properly classify them, to produce project-related knowledge and to know to share it in the virtual collaboration space:

- know various processes applied in online project management and be aware of the value of information reusing and adaptation
- provision of access to own information and facilitation of cooperative working on shared resources
- plan and implement shared resource creation of the project.

A.5. *Recognize diversity ensuring team cohesion by virtual collaborative means* - to be aware of the different approaches and methodologies in working/communication that may be applied by the distributed teams, to understand such diversity and to self-organize/adapt using virtual collaborative means:

- ability to adapt to different collaboration styles and to encourage creative thinking by accepting the diversity
- capacity to identify the collaborative interactions with the virtual space and its artefacts
- improve online project management skills by working in multinational teams.

A.6. *Demonstrate effective interpersonal communication skills* - to be competent in the evaluation of the communication requirements in the project, to be able to set-up specific ICT tools for communication:

- demonstrate ability to observe facts and to provide fast and accurate communication feed-back to the team members
- practice active listening; make the team members to think and make them feel positively challenged

- develop and enhance the communication channels with the project team by using specific ICT tools.

A.7. *Manage virtual collaboration processes* - show abilities and proficiencies in mapping project planning into the virtual collaboration platform in order: to have full-control of project management, to be effective in project documentation and to solve possible technical problems using the community experiences:

- be able to match the project planning into the virtual collaboration framework and to document this process according to best practices
- effectiveness in: regular project reporting, documentation, organisational behaviour, self-organisation, and technical problem reporting
- quick solving of technical problems based on: own skills, group collaboration or exploring the available technical knowledge-base.

B. COMPETENCIES FOR ONLINE PROJECT PLANNING

B.1. *Project planning and time management competencies* - project planners should develop a basic knowledge and practice of available project planning and time management techniques and understand how to apply such techniques in projects:

- project management standards related to project planning and time management,
- abilities to comprehend and accomplish project planning and time management in a general context,
- optimisation of and efficient planning

B.2. *Conformity to different work attitudes* - understanding and incorporation of differences in work attitudes between team members in project planning and provide an environment that integrates and allows a highest level of conformity to work attitudes of different kinds, both in terms of work and time commitments:

- awareness and capacity of understanding different work attitudes,
- work and time accordance with specification and personal time / work commitments,
- effectiveness in scheduling and organising work.

B.3. *Complexity and transparency management* - project teams should be able to always estimate and redefine the scope and effort of project activities in both initial project plans and continuous progress reports that comprehensively show transparency of all project proceedings and time correspondence to team members:

- understanding and measuring the objectives of the project and constant adaptation to changing project requirements,
- transparency in distributed project proceedings and synchronisation of processes,
- comprehensive and clear project statements, especially regarding synchronisation of work and times

B.4. *Adjustment to time differences* - project managers should understand and incorporate differences in local work schedules of team members in the project planning process and transport those to all team members. Core Times for (synchronous) joint activities and an environment that supports the timely progress of the project should be defined:

- capacity to adapt the own time planning to time differences of the multinational teams. Finding and negotiating the "global time" on the most effective time adaptation according to the "local schedules"

- level of conformity to local work schedules and project time and work commitments

- scheduling and synchronising distributed work.

B.5. *Adaptability of managerial skills* - project managers should develop and leverage their knowledge of differences between distributed work groups (e.g. work attitudes, work schedules, motives, cultural backgrounds) in their leadership to achieve best time and work efficiency:

- cooperation and virtual collaboration in definition of the project tasks, resource planning, time planning and an unitary view in understanding the philosophy of the project and project documentation. They must make sure within the project team that work between the work groups will be synchronised where it is necessary
- deliver joint outcomes resulting from sharing the same project planning and using the same quality evaluation criteria
- reliable and confident collaboration and joint co-operation to achieve the outcomes.

B.6. *Common understanding* - team members should support the creation of a common understanding and practice by definition of and commitment to a common terminology as well as work and time agreements:

- capacity to achieve a joint commitment in the virtual collaboration framework
- ability to easily adapt and understand different practices and work arrangements project management
- common understanding of and commitments to terms and arrangements

B.7. *Team awareness* - team members of the project should build up a framework by means of formal and informal channels that enables them to capture and encourage a common team identity. Project managers should actively contribute to an environment that encourages such team identity and use this framework to coordinate the team effectively in a virtual team:

- ability to understand the team identity
- effective collaboration and communication in team
- proficiency for team awareness

B.8. *Modularity in methodology and techniques* - project planners should understand how to flexibly select and deploy project management techniques in a distributed environment, regarding differences in complexity and requirements of the distributed environment:

- abilities to be aware of the effects and implications of a wide range of related techniques and methods in a distributed and virtual environment.
- adaptation to changing international requirements of project planning and time management
- optimisation of techniques and methods.

The above described competencies in the categories virtual collaboration and project planning as well as competencies on: communication, project documentation and intercultural communication have been evaluated by the industry partners in the frame of an online survey. The interviewed companies have been asked to rank the relevance of each competency (for online project management) with “low”, “medium” and “high”. The results for virtual collaboration and project planning are given below and it can be seen that most of the competencies have been ranked as with “high relevance” in percentages higher than 50% as the “low relevance” is in average under 10%.

Table I. The relevance of virtual collaboration competencies

| Competency | Relevance | | |
|------------|-----------|--------|------|
| | Low | Medium | High |
| A.1. | 2 % | 36 % | 62 % |
| A.2. | 6 % | 53 % | 41 % |
| A.3. | 4 % | 12 % | 84 % |
| A.4. | 4 % | 38 % | 58 % |
| A.5. | 10 % | 53 % | 37 % |
| A.6. | 4 % | 38 % | 58 % |
| A.7. | 10 % | 38 % | 52 % |

Table I. The relevance of project planning competencies

| Competency | Relevance | | |
|------------|-----------|--------|------|
| | Low | Medium | High |
| B.1. | 0 % | 36 % | 64 % |
| B.2. | 11% | 31 % | 58 % |
| B.3. | 2 % | 25 % | 73 % |
| B.4. | 22 % | 22 % | 56 % |
| B.5. | 2 % | 45 % | 53 % |
| B.6. | 2 % | 38 % | 60 % |
| B.7. | 4 % | 32 % | 64 % |
| B.8. | 2 % | 38 % | 60 % |

CONCLUSIONS

The results of a research survey for the identification of the competency profile required to train engineering students in online project management under industry conditions and in the frame of a multinational cooperation have been presented. The training profile is a multidimensional one, considering the structuring of the competencies in several classes. The survey made among the industry partners aimed to check the validity of the identified competencies as well as to anchor the results into the state of the art of the labour market and into the current industry practices. Starting from these types of competencies, the curriculum and the training handbook will be developed in the near future.

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^(*) NOTE: Project implemented with the financial support of the European Commission within the Leonardo da Vinci Program A/04/B/F/PP/158128.