



## Document Control

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## Executive summary

Based on the theoretical background of development of competencies and the development and sharing of knowledge, two descriptions of pedagogical scenarios are offered: Virtual Company (VC) and Virtual Project (VP), including their accompanying assessment strategies.

To perform project tasks, both scenarios require the offering of an authentic learning and working environment to the student, which contributes to overcoming two classical educational problems: the transfer and the motivation problem.

Fundamental assumptions about supporting learning are:

- The learning environment is a reflection of an authentic business working environment that maintains as much as possible of the original complexity
- Assignments are carried out that have been formulated by real customers
- Working and learning in teams is a necessity, with a clear advantage
- Room is available for reflection and integration of new insights, with visible consequences.
- Assessment is performed based on professional criteria, like those used for assessing professionals in a company
- IT-tools are used functionally to facilitate actions

In VC and VP students perform real tasks from real customers in a real working environment. For VP the environment does not need to be as elaborate as for VC, because the projects that are worked on are not embedded in a company setting. To give an impression of the processes that occur in VC and VP, an overview of roles, tasks, results and tools is presented.

As the project work resembles the project work in real business, so do the assessment rules need to resemble the rules in real (job-talk) assessments. The assessment rules are derived from performance standards in real companies and apply to the students from job application to the end of contract.

While working, students keep track of their competency growth by means of a personal portfolio and a project record for the team they are part of. These items are assessed several times during the students stay in the project. But as assessment as a grading tool is relatively new, it is not readily accepted everywhere. Therefore we present a way to secure relative objective assessments, even though in real life assessments are implicitly subjective as they also focus on the soft (people) skills.

We conclude this report by addressing some issues to be dealt with in the next Cooper year.

## **1.1 Cooper aims**

The COOPER project is dedicated to support long-distance cooperation of teams of students working on complex projects in the following learning environments:

- Graduate (or post-graduate) university studies, involving students and lecturers participating in focused projects (e.g., masters or specialization courses) coming from different institutions and backgrounds;
- Company universities and company training, involving multi-national participants coming from company's sites or customers which are world-wide dispersed, participating in the launching of new product or technology, or in product- and project-centred training.

Based on these requirements, COOPER will develop and test a model-driven, extensible environment that supports individual and collective competency building in virtual teams, whose members are geographically dispersed, have different backgrounds and competencies, working together in projects to solve complex problems. The project will achieve this goal by focusing on and providing the following results:

- Create a reference model for cooperative teamwork processes;
- Create interoperable and validated pedagogical scenarios and assessment strategies;
- Create and test tools to support knowledge co-construction, sharing and re-use;
- Create a common COOPER software platform in which these models, scenarios, strategies and tools are integrated;
- Gather requirements as well as pilot results and evaluations in representative case studies.

## **1.2 Scope of the report**

The current report will focus on the creation of interoperable and validated pedagogical scenarios and assessment strategies. From the onset of the project, the effort focussed on two scenarios, called Virtual Company and Virtual Project. The report will restrain from presenting a broad overview.

After describing the general aims of learning in online project-centred teams, we will describe the two didactical scenarios, including the accompanying assessment strategies, which are designed to achieve these aims. An overview of soft skills (personal, emotional and social skills, like communicating and organising), to be developed using the pedagogical scenarios, is included.

# **2 Learning in online project-centred teams**

## **2.1 Aims of computer supported collaborative learning (CSCL)**

CSCL is learning as a result of computer-supported interaction between two or more persons, aiming at reaching a preconceived learning goal. Students are responsible for one another's learning as well as their own. The learning environment is organised in such a way that students can contact each other, work collaboratively on a task, and that students' interactions

concerning the task contribute to the learning process of each individual student (Dillenbourg, 1999, 2003; Kreijns, 2004). This task-based interaction can be roughly organised in two different ways (Dillenbourg, 1999, 2003; Panitz, 1996): co-operative or collaborative. In co-operative interaction each individual student performs a part of the task and the separate results are later combined to acquire a group result. In the collaborative interaction students analyse the task, share and discuss ideas, elaborate on the content collaboratively and with mutual understanding to acquire the group result. In this way students are positively interdependent and have a shared responsibility for the final group result. The latter type of collaboration requires the most intensive form of collaboration and interaction on different levels; content-related and coordination-related.

### **2.1.1 Development of competencies**

A competence is the integrated application of knowledge, skills, experience and attitudes to solve a problem, to perform an activity or to handle a situation in a certain (professional) context (Friesen & Anderson, 2004; Sandberg, 2000). In order to develop competences learning has to take place in an authentic context, so that concepts and skills are anchored within the context of an area of study. A computer supported collaborative team solving a (professional) problem can serve as such a context and as a preparation for team based collaborative work and problem solving in the later profession.

Several skills, which are underlying competences, could be practiced by working in a collaborative team. Proponents of collaborative learning claim that the active exchange of ideas within small groups not only increases interest among participants but also promotes critical thinking and problem solving skills in general. According to Johnson and Johnson (1986), there is persuasive evidence that cooperative teams achieve at higher levels of thought and also retain information longer than students who work quietly as individuals. The shared learning gives students an opportunity to engage in discussion, take responsibility for their own learning, and thus become critical thinkers (Totten, Sills, Digby, & Russ, 1991). Collaborative learning fosters the development of critical thinking through discussion, clarification of ideas, and evaluation of others' ideas.

Besides problem solving and critical thinking skills, skills to be practiced can include designing, decision-making, producing, researching and reflection skills and more soft skills, like communicating, collaborating and organizing.

### **2.1.2 Develop and share knowledge: creating common ground and meaning**

Within contemporary education CSCL is mainly used to promote knowledge co-construction among learners. The aim of knowledge co-construction is often seen as an important feature of a powerful learning environment (Van Merriënboer & Paas, 2003). Group diversity in terms of knowledge and experience contributes positively to this learning process, e.g; Von Glaserfeld (1988) discussed the social construction of knowledge where concepts are developed in a process of fine-tuning involving interaction with others. Collaborative learning that emphasises the need to examine an issue from all perspectives on a theme gives students the understanding of various points of view. However, research shows that online collaboration doesn't happen spontaneously and automatically; that interactions are superficial, and often knowledge building remains at a surface level (Dewianty, Brand-Gruwel & Jochems, 2005; Häkkinen, 2004; Kirschner, Jochems & Kreijns, 2003; Strijbos, Kirschner & Martens, 2004). Also the quality of learning results and satisfaction of the learners can be disappointing when CSCL is not well organized (Hooper, 1992; Johnson & Johnson, 1994; Kagan, 1994; Kirschner, 2003).

The virtual project and the virtual company scenario's are two different ways of organising students learning in online project-centred teams that strive to support learning.

### **3 Didactical scenario's for online project-centred team-learning**

The Cooper environment enables modelling of didactical scenarios supporting learning through participation in online project-centred teams. The flexibility of the platform makes it possible to model scenarios that have the "teacher in control", but also to model for "the student in control", in that we can provide room for students to (learn to) develop and reflect upon their own work methods in the projects.

#### ***3.1 Didactical scenarios: Virtual Company and Virtual Project***

##### **3.1.1 Aims**

With didactical scenarios that make use of organizational contexts, two mayor issues in education are addressed:

- the "transfer" problem (how to apply knowledge from formal education in the real world),
- the "motivation" problem (how to motivate students when tasks are non-authentic)

We aim to prevent these problems by providing students with an authentic environment in which they can learn while working.

##### **3.1.2 General description of VC and VP**

In both VC as in VP, students perform tasks in virtual project teams. The main difference between the two scenarios is the fact that in VP an authentic company context is missing. However, depending on choices made in the design of VC and VP, both scenarios can be used to primarily support knowledge acquisition (more resembling traditional education) or competency development.

To illustrate and clarify these differences, we will describe the VP-scenario from the knowledge acquisition point of view and the VC-scenario from the competency development point of view.

An overview of differences between VC and VP is also presented in Table 1 below.

##### *VC*

The VC concept situates learning in a virtual business environment, enabling learning-while-working. (Van Petegem et al. 2000, Schön 1987, Brown & Duguid 2000, Van der Vleugel 2000). The VC concept is built on notions like social constructivism, competence based learning, communities of practice, the learning organization, (Jonassen 1994, Kessels 2001, Lave & Wenger 1991, Westera and Sloep, 2001).

Designing a VC environment is about creating an open, complex business environment. It is about setting conditions that help a student/trainee find his/her way during task performance, rather than giving explicit instructions. In the VC individual learning, defined as increasing an individual's capacity to take effective action, is coupled to team and organizational learning. This is done, for example, by linking role performance to business performance and by stressing that learning occurs integrated within work processes. A VC environment may be

characterized both as an organization for learning (as it explicitly addresses competency growth of its employees) and as a learning organization (as it improves upon itself by adapting to new business demands). Individual competency growth takes place within the collective pursuit of the customer's needs.

In the VC, construction of knowledge takes place in social interaction with peers. Students/trainee's in a VC-environment have a role as (starting) professional. They work in teams on real tasks with real customers; they perform duties and have responsibilities for the development of the VC-organization as a whole. In doing so, they explicitly work on their personal development. Organising this work is to a large extent the responsibility of the students/trainee's themselves.

Learning in a corporate VC environment takes place within the context of a constantly evolving, modern organization, in which the traditional boundaries of individual learning disappear. Individual learning objectives may include competency growth in ongoing work practices; they may also be tuned to, for example, new work practices. Learning activities are preferably performed virtually and asynchronously, in order that the participants' learning interactions may easily fit in with their work duties.

### *VP*

The VP concept situates learning in an educational institutions e-learning environment, enabling learning-while-working.

Designing a VP environment is about creating an open, complex project environment. It is about providing materials that help a student/trainee find his/her way during task performance, through explicit instructions. In the VP individual learning, defined as increasing an individual's capacity to take effective action, is coupled to team learning. This is done, for example, by linking role performance to team performance and by stressing that learning occurs integrated within work processes. Individual competency growth takes place within the collective pursuit of the customer's needs.

In VP, construction of knowledge takes place in social interaction with peers. Students/trainee's in a VP-environment have a role as student. They work in teams on real tasks with real customers. In doing so, they explicitly work on their personal development. The organisation of the work is prescribed in a work method provided by the educational institution.

When learning in a VP, the individuals learning objectives are derived from the end terms laid down in the educational institutions curriculum.

### **3.1.3 General characterization:**

Some general characteristics of VC and VP are:

- The learning environment is a reflection of an authentic environment that maintains as much as possible the original complexity (authentic learning in a contextualised and complex surroundings)
- Projects are carried out that have been formulated by real customers (the learner should be involved in complex and unstructured tasks)
- Working and learning in teams is a necessity (collaborative and communicative learning)
- Room is available for reflection and integration of new insights (active, constructive and reflective learning)

- Assessment is performed based on professional criteria, like those used for assessing professionals in a company, rather than, or in combination with, educational criteria (authentic assessment)
- IT-tools are used functionally to facilitate actions (IT is a tool, not an end)

### 3.1.4 Differences between VC and VP

The Virtual Company can be seen as a project organisation that adds an extra authenticity layer by means of the company setup. The management has a supporting, facilitating role. In the VC we enable students to:

- Work in an open and developing business environment, that runs continuously
- Work on complex, non-routine problems from the professional or scientific practice, from both clients as the company itself
- Work on quality assurance in accordance to practice, and assessment by means of professional criteria
- Receive explicit support from the VC in active construction of knowledge, new ideas and work methods
- Be supported by an IT-Infrastructure enabling working in distributed teams

The virtual project distinguishes itself from the VC in that a real, open business environment is missing. "Learning while working" happens inside the learning environment of the (educational) institution. The teacher has a more directing role. In VP's students can:

- Work on complex, non-routine problems from the professional or scientific practice
- Work on quality assurance in accordance to criteria set by the educational institution
- Get explicit support from the educational institution in active construction of knowledge, new ideas
- Be supported by an IT-Infrastructure enabling working in distributed teams

Phase/Scenario	VC(running continuously)	VP (restarts after project is finished)
<b>0.Design of the VC</b>	The company's domain is chosen, business rules for assessment etc. are researched	Rules for assessment are derived from curriculum
<b>1.Acquisition of orders</b>	The VC acquires orders from real customers in its role as company	The educational institution acquires the orders from real customers
<b>2.Project start/planning</b>	Trainees(starting professionals) are required to apply for a job (external and internal projects)	Students are placed in groups and a project is assigned
<b>3.Project execution</b>	While working, assessment of project work is mainly aimed at quality assurance and learning on the job, fulfilling ones own learning goals, assessed by own criteria.  Defining of the work process and reflecting on it are part of the learning goals.  Two kinds of projects:  -Internal, aimed at improving the	While working, assessment of project work is mainly aimed at fulfilling learning goals set by the educational institution.  The work process is predefined by the educational institution

	company processes -External	
<b>4.Project end</b>	The project results are presented to the customer and assessment is performed.	The project results are presented to the customer and assessment is performed.
<b>5.Consolidation of results</b>	Results are saved and can be consulted by new teams, a knowledge base and company history is maintained. The company design is evaluated.	Results are saved for other teams to consult.

**Table 1:** Main differences between VC and VP

### 3.1.5 Design components

We distinguish the following design components for VC and, to a lesser extent, VP (as explained above):

- An authentic or real business or project setting
- Complex, non-routine, ill-structured tasks (duties, responsibilities)
- Explicit facilitation of active construction of knowledge, new ideas, working methods
- Assessments derived from professional practice and its performance standards
- A supporting IT infrastructure

#### 3.1.5.1 Elaboration on the design components

##### *Authentic or real business setting*

The integration of learning and working tends to mask a profound duality in the mission of virtual company learning. A VC environment simultaneously tries to realize optimal performance to serve its customers and optimal learning to serve its employees. Quality control in a VC environment therefore relates to both quality of performance and competency growth. Included in competency growth are also the contributions that employees make to the development of the organization as a whole. However, the VC concept leaves open design opportunities to put more emphasis on *learning* (users are more like students) or on support in *task performance* (users are (more like) professionals). Several possibilities to use the VC-environment have been identified, on the first two of which the COOPER project will focus:

- Learning in real business example: the VC will be aimed at training students through virtual business learning.
- HRM: developing the potential of the staff
- Organizational prototyping: the envisioned business model after a reorganization of an existing business. A new organization model, with its processes and roles can be tested through organizational prototyping
- Chain management: the role the business plays is a business chain to be developed. The interaction with other members of the value chain can be modeled, so employees can be trained for a real world situation
- Networking: developing inter business work processes.

The company staff roles that are to be fulfilled are derived from the business model and are performed as in normal business. We tend to differentiate between roles like:

- Performed by educational institutions staff:
  - CEO (Chief Executive Officer, the person ultimately responsible for the actions of the company)
  - HRM (Human Resource Manager, the person responsible for intake of students, placement in projects and coaching of the learning process)
  - IT-Helpdesk (Person to help trainees with possible IT problems)
- Performed by students/trainees
  - Project leader (leading the team in performing their task)
  - Project workers (performing project tasks)

### *Complex, non-routine, ill-structured tasks (duties, responsibilities)*

Whether tasks are acquired from customers or from the VC itself, they need to be screened for sufficient complexity in relation to the learning goals of the trainees and the company.

Teams are then formed around a task at hand, and roles are agreed upon.

Team members must fit the requirements for performing their role in such a way they can learn while performing the task. This means the task has to be complex enough to enable every team member to work on some competencies. Mapping tasks to individuals and teams for optimal competency growth is not a trivial matter, as there probably will not be perfect solution to the equation. The outcome will be the result of an negotiation process.

We distinguish between different tasks, each delivering their specific gains to the company:

- Tasks from real customers. While initially acquired by the educational institution in its role as a company, trainees can also acquire tasks from the domain. Completion of such a task sustains the company in reputation at least, but possibly also in financial sense.
- Internal projects that are used to develop the company as a whole. It is expected of trainees to deliver a contribution to the development of the company as a whole, be it improving upon communication (systems), knowledge management (systems) and work processes in general.

### *Explicit facilitation of active construction of knowledge, new ideas, working methods*

When trainees start to work in the VC, they are submerged in an already running business. They blend in by getting acquainted with normal business practice. They form a team and choose a task that fits best to their collective learning goals. While working on their tasks, trainees will inevitably be confronted with problems they do not yet know how to solve. Several knowledge sources are supplied to the trainee:

- Fact sheets (short descriptions of solutions to problems available “just-in-time”)
- Descriptions of project methods (enabling work planning)
- A knowledge base, already built by previous project teams (procedural)(company memory)

- Knowledge management tools (database, definitions, experts to consult etc.)
- A project archive (containing results of previous project teams)

### *Assessments derived from professional practice and its performance standards*

Upon entry and during the trainee's stay in the VC, several assessments are performed:

- Intake assessment: when applying for a position in the VC, the trainee is assessed. This intake assessment should provide the trainee and VC with a picture of the current level of the trainee's competencies and of his/her learning goals. Both soft and practical skills are assessed.
- 360<sup>o</sup> assessments: while working in the VC, on regular intervals, the trainee is asked to assess him/herself (self assessment) other workers (peer assessment), as other workers are asked to assess current performance of the trainee. These include the "managerial" roles as well.
- Reviews: based on the project plan, the current state of affairs in the project is assessed, aiming at improving the end result of both product and work process (quality assessment, including assessment from the customer)

Instruments that can be used to prepare a trainee for intake assessment are for example the Workplace Big 5 test, learning style tests, leadership role tests, etc.

### *Supporting IT infrastructure*

Any VC/VP environment has to simultaneously support both formal and informal learning activities. It therefore requires an advanced, virtual infrastructure for learning while performing at individual, team, and (for VC) higher organizational levels. This virtual infrastructure should be rich in "social" knowledge construction opportunities, making available a wide range of communication tools.

To support learning, an IT infrastructure closely resembling a normal IT working environment should be set up. As "Virtual" in our case means that workers are separated by time and space, an internet-based workspace should be available, supporting processes for creation, communication and organization. A company website (extranet/intranet) with information for clients, tools and rules of conduct and regulations should also be provided.

#### **3.1.5.2 Overview of roles, tasks, tools, interactions and outcomes in the design and running of VC and VP**

The following table presents an overview of the design and running of the VC scenario in the Cooper environment. For clarity we only include the VC scenario. But based on the differences between VC and VP, a similar matrix can be constructed for VP.

The development phases in table 2 fit in the standard Cooper project phasing as follows:

Pre-project phase = phases 1 and 2

Project phase = phases 3 and 4

Post-project phase = phase 5

Tools mentioned in *italics* are supposed to be available in the COOPER environment. The other tools are either available at the students computer, or the designers computer.

<b>Roles</b>	<b>Phase / Tasks</b>	<b>Tools needed</b>	<b>Interactions system/roles</b>	<b>Outcome</b>
	<b>0. Design of the VC</b>			
<b>Developers/ CEO, Coach, HRM</b>	Defining the domain of the Company (from hosting company or faculty knowledge domain)	-Website editing tool  -Productivity tools  <i>-Communication tools</i>  <i>-Shared folders</i>	-Create internet/intranet websites  -Create interaction possibilities between trainee/team and CEO, coach, HRM (accounting and communication structure of the company)	-Web site informing clients, including mission, vision, aims strategy statements (internet)  -Working protocols (on intranet)
<b>Coach/HRM</b>	Research assessment rules:  Quality cycle using professional criteria for <ul style="list-style-type: none"> <li>- Team</li> <li>- Individual</li> <li>- Company</li> </ul>	-Website  <i>-Individual folder</i>	-Design/prepare individual folders (portfolio)  -Create documents in shared folder or create website pages	-Performance criteria(intranet)  -Assessment rules(intranet)  -Portfolio
	<b>1. Project definition /acquisition.</b>			
<b>Developer /Coach</b>	Creation of domain-specific resources	-Website editing tool  <i>-Individual folder</i>  -Website  <i>-Shared folders</i>  <i>-Knowledge base folders (repository)</i>	-Design/prepare shared project folders  -Design/prepare knowledge base  -Design/create templates <ul style="list-style-type: none"> <li>• lessons learned</li> <li>• team performance plan</li> <li>• personal performance plan</li> </ul>	Resources, for example:  -Books, articles to read  -Experts to contact  -JIT(Just –In-Time)-information (how-to's) on specific tasks  -Project method descriptions to choose from

Roles	Phase / Tasks	Tools needed	Interactions system/roles	Outcome
			<ul style="list-style-type: none"> <li>project plan</li> <li>application form</li> </ul>	-Knowledge base (lessons learned, company history...) to consult
<b>CEO</b>	Acquisition of projects -External -Internal	- <i>Individual folder</i> - <i>Shared folder</i>	-Archive communications with client  -Publish project descriptions (intranet, documents?)	-Description of projects for trainees to choose from
<b>Coach/HRM</b>	Project analysis - Tasks - Competencies to be achieved when performing task	-Task/Competency mapping tool or manually analyse projects  - <i>Shared project folder/web page</i>	-Create documents in shared project folder or pages on website  -Create web page with vacancies	-List of competencies and levels to be achieved when performing roles/tasks in project (intranet or documents) (list also showing up in trainee application form)
				<b>Summed up, the outcomes of the phases above constitute the working environment offered to the trainee.</b>
	<b>2. Project start/planning</b>			
<b>Trainee</b>	Application to VC	- <i>Web site form/Document</i>	-Fill out application form (data included from list of competencies)	-Application to VC
<b>Trainee</b> <b>Coach</b> <b>HRM</b>	Intake assessment: - Qualifications needed o Available o Recruit - Targets o Subject related	- <i>Individual folder</i>  - <i>Web site forms</i>  -Task/Competency mapping tool  -Face-2-Face	-Synchronous communication between Coach/HRM and Trainee  (Video, audio, application sharing)	Discussed, negotiated and agreed upon:  -List of student's competency wishes, selected from competencies available in tasks

<b>Roles</b>	<b>Phase / Tasks</b>	<b>Tools needed</b>	<b>Interactions system/roles</b>	<b>Outcome</b>
	<ul style="list-style-type: none"> <li>○ Soft skills</li> </ul>	meeting/ <i>Communication tools</i>		(data to be used from list of competencies and application form)
<b>Coach</b> <b>Trainee</b>	Team formation: <ul style="list-style-type: none"> <li>- Task allocation               <ul style="list-style-type: none"> <li>○ Subject related</li> <li>○ Soft skills</li> </ul> </li> <li>- Role allocation</li> </ul>	<ul style="list-style-type: none"> <li>-<i>Project folder</i></li> <li>-<i>Student individual folder(portfolio)</i></li> <li>-Task/Competency mapping tool</li> <li>-Face-2-Face meeting/<i>Communication tools</i></li> </ul>	<ul style="list-style-type: none"> <li>-Give access to appropriate folders/resources</li> <li>- Synchronous communication between Coach and Trainee (Video, audio, application sharing)</li> </ul>	Discussed, negotiated and agreed upon: <ul style="list-style-type: none"> <li>-List of mapping between student competency wishes and tasks,</li> <li>-Team formation based on optimal matching between tasks, personal wishes and team requirements</li> <li>-Trainees mapped to roles in the team</li> <li>-Teams with access to team project folder</li> <li>-Personal development plans</li> </ul> (data to be used from list of competencies and application forms)
<b>3. Project development/Quality Control</b>				
<b>Team</b> <b>Coach</b>	Prepare project plan, f.e. containing: <ul style="list-style-type: none"> <li>- Phases</li> <li>- Milestones</li> </ul>	<ul style="list-style-type: none"> <li>-<i>Project folder</i></li> <li>-<i>Student individual</i></li> </ul>	<ul style="list-style-type: none"> <li>-Place documents in folders</li> <li>-Use communication tools</li> </ul>	The team defines its own performance criteria in: <ul style="list-style-type: none"> <li>-Project plan, including review</li> </ul>

<b>Roles</b>	<b>Phase / Tasks</b>	<b>Tools needed</b>	<b>Interactions system/roles</b>	<b>Outcome</b>
<b>Client</b>	<ul style="list-style-type: none"> <li>- Deliverables</li> <li>- Resources</li> <li>- Tasks</li> <li>- Planning</li> <li>- Review</li> <li>- Assessment criteria</li> </ul>	<i>folder(portfolio)</i> -Planning tool - <i>Communication tools</i> -Productivity tools - <i>Resources</i> - <i>Assessment tools</i>	-Use assessment tools -Use shared Calendar	plan etc -Revised project plan -Team development plan -Team assessment plan
<b>Team</b> <b>Coach</b> <b>HRM</b> <b>Client</b>	For each phase (cyclic process) <ul style="list-style-type: none"> <li>- Perform tasks</li> <li>- Consult resources</li> <li>- Produce and review deliverable</li> <li>- Assess</li> </ul>	- <i>Project folder</i> - <i>Trainee individual folder(portfolio)</i> - <i>Knowledge base folders (repository)</i> -Planning tool - <i>Communication tools</i> -Productivity tools - <i>Assessment tools</i>	-Place documents in folders -Use communication tools -Use assessment tools -Update portfolio	-Product (intermediate) -Product assessment (intermediate) -Team and individual assessment (intermediate)
	<b>4. Project End/Delivery of result</b>			
<b>Team</b> <b>Coach</b> <b>HRM</b> <b>Client</b>	-Present and hand-over of project result	- <i>Assessment tools</i> -Face-2-Face meeting/ <i>Communication tools</i>	-Use assessment tools -Present result	-Product (end) -Product assessment (end) -Team assessment (end) -Individual assessment (end)

Roles	Phase / Tasks	Tools needed	Interactions system/roles	Outcome
	<b>5. Consolidation of results</b>			
<b>Team</b> <b>Coach</b> <b>HRM</b>	-Update lessons learned, company history, project archive	<i>Knowledge repository, project archive</i>	-Place documents in folders, repositories -Use forms (lessons learned) -Update websites	-Updated knowledge base, project archive, adapted company rules,

**Table 2:** Roles, tasks, tools, interactions and outcomes in the design and running of VP and VC

### **3.1.6 Assessment and assessment tools**

Assessment in VC and VP is based on the individual and team performance of the learner. In a portfolio, learners keep record of their progress in respect to the goals set forth in their personal development plans. Materials to support the personal competency growth are deposited in a portfolio. On the team-level, regular progress reports are deposited in the project folder, showing team and personal performance. At prearranged intervals the personal development plans and the team progress reports are assessed by other learners, the teacher (or HRM manager) and the customer. This leads to a realistic assessment of “all inclusive” personal growth. Assessment will be aimed at both professional and personal (soft) skills.

Assessment is an integral part of learning and working in a VC or VP. It aims at assessing the work performed by the trainees for:

- Themselves
- In the context of the project team
- In the context of the virtual company (only VC),
- Through means of self, peer and 360<sup>0</sup> assessments.

The assessment criteria are based on real world criteria:

- Criteria stem from, for example, job descriptions in vacancies in the real world or a domain knowledge model available somewhere,
- Criteria are divided in “subject related” and “soft skills”,
- Trainees and teams partly formulate the criteria and level of performance on which they want to be assessed.

The assessment cycles:

Assessment criteria are derived from the company’s performance goals:

- The company defines goals, acquires projects fitting these goals and defines quality criteria for projects,
- The goals for project team are derived from these (teams contribute to the development of the company in both knowledge and organizational form),
- Trainees work on achieving personal goals, derived from the project team goals.

#### **3.1.6.1 About portfolio assessment**

According to Paulson, Paulson, and Meyer(1991, p. 63) "Portfolios offer a way of assessing learning that is different than traditional methods. Portfolio assessment provides an opportunity to observe persons in a broader context: taking risks, developing creative solutions, and learning to make judgments about their own performances."

The disadvantage of portfolio assessment is that portfolios are not as quick and easy to evaluate, plus they are harder to rank with a grade or score. Because portfolios are qualitative, many people find them difficult to use as a determinant of a candidate's skills. Often, e.g., employers would rather see a quantitative demonstration of a candidate's best skills and work.

As portfolio assessment is closely related to the performance criteria and assessment methods used in the “real world” (like job talks between employee and manager, with colleagues playing the role of informer, delivering input for the talk) we believe it to be the grading tool of choice in VC and VP.

Inside the students portfolio at least the following items should be placed:

- The personal development plan
- The reflection reports (self assessments)
- The work produced
- The assessments of peers from peer assessments

### **3.1.6.2 How to Assess/Evaluate a Portfolio**

In order for thoughtful portfolio assessment to take place, evaluators can utilise multiple scoring strategies to evaluate a person's progress. Criteria for a finished portfolio might include several of the following:

- Thoughtfulness, including evidence of a person's monitoring of his or her own comprehension, meta-cognitive reflection, and productive habits of mind.
- Growth and development in relationship to key curriculum expectancies and indicators.
- Understanding and application of key processes.
- Completeness, correctness, and appropriateness of products and processes presented in the portfolio.
- Diversity of entries e.g., use of multiple formats to demonstrate achievement of designated performance standards.

It is especially important to prioritize those criteria that will be used as a basis for assessing and evaluating people's progress, both formatively (feedback without formal consequences) and summatively (determining the extent to which the assessment criteria and performance standards have been achieved to reach a formal conclusion).

Some form of oral discussion or investigation should be included as part of the summative evaluation process. This should involve a panel of reviewers in an exploration of the portfolio components, the person's decision-making and evaluation processes related to the content of the portfolio and other relevant issues. [Burke, Fogerty (1994)].

### **3.1.6.3 Overview of cycles in personal, team and company competency development**

In VC and VP, a person's role performance related to his/her team's performance and (in case of a VC) the company performance criteria. A cycle of activities is discernable on three levels: the Personal, the Team and the Company level. It is important to understand the interwoven nature of competency development and assessment in the VC and VP pedagogical scenarios.

<p>VP and VC</p>	<p>VP and VC</p>	<p>VC only</p>
<p><b>Personal development:</b></p> <ul style="list-style-type: none"> <li>-Personal development in VC is furthered in two ways: <ol style="list-style-type: none"> <li>1. Every individual chooses one or more roles, tuned to personal development wishes.</li> <li>2. For each role, specific support is available.</li> </ol> </li> <li>-The starting professional (trainee) needs to have influence on the performance criteria of the separate roles and accompanying results.</li> <li>-Competence and Assessment need to be understood in a business-like fashion: there is a direct link between competency and business results. Results and accompanying performance criteria are derived from business mission and goals of the VC.</li> </ul>	<p><b>Team development:</b></p> <ul style="list-style-type: none"> <li>-Formation of a team (assigning roles and projects) is related to the expertise at hand <i>and</i> the individual's competency wishes. This is a process of negotiation.</li> <li>-The project work plan is developed in parallel and in tune with the personal development plan</li> <li>-A VC team should be able to choose its own modus operandi from several possibilities and should be accountable for its choices. These choices, together with quality criteria for product and team performance and the specific needs of the customer are being laid down in the project plan. This can lead to fine-tuning of modus operandi, quality standards etc. provided by the VC, during or after the project work phase</li> </ul>	<p><b>Company development:</b></p> <ul style="list-style-type: none"> <li>-Realizing competency growth for all of its employees is the central goal of every VC.</li> <li>-Rethinking of modus operandi and seemingly obvious preconceptions aimed at actualizing the company design is part of the VC conduct.</li> <li>-In virtual companies, teams and individuals also have a responsibility for the improvement of the organization they work for. Lessons learned are of importance for future teams of employees and the design of the company itself.</li> <li>-The VC organization behaves itself towards teams in a facilitating manner.</li> </ul>

	<p>-Sessions are scheduled on regular intervals to check quality. These can be reviews (start-up review, result and process reviews) but sometimes also tests (acceptance tests, systems testing) or inspections (Fagan inspections, walkthroughs). The project team should choose its own quality assurance method and account its choices.</p> <p>-Drawing up Lessons Learned and defining possibly reusable object for the company are an essential part of closing a project. These results help to further develop the VC.</p>	
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**Table 3:** Interwoven personal, team and company competency development and assessment in VC and VP

### **3.1.6.4 Assessment criteria**

As stated earlier, assessment criteria for the VC and, to a lesser extent, VP need to be derived from professional practice. To derive an overview of competencies to be acquired while performing in a VC, an investigation into the competencies required of well-performing professionals in a knowledge domain is needed, as these cannot be set up before the domain of the VC is chosen.

Sources could be:

- Published job vacancies in the relevant knowledge domain
- Interviews with performing professionals
- Interviews with domain HRM managers
- Domain ontologies
- Curricula from educational institutions

An overview of the more general soft (people) skills is presented in Appendix 1.

## **4. Further development**

For the following year of development in the COOPER project we see several points that need to be addressed:

- The development of a scoring/assessment tool (adaptation of the evaluation tools developed in WP5), including a scoring model describing how to arrive at an assessment result, middling the results for domain knowledge learning and development of soft skills
- The implementation of first the VP scenario and later the VC scenario in the COOPER environment
- The evaluation of the implementation and run of the educational scenarios
- Based on the outcomes of these evaluations, the possible extensions to the COOPER data model and tools

## Appendix 1: Overview of assessment criteria for soft skills

Competence	Description	Criteria
<b>Group 1: Research</b>		
1.1.1 Identifying problems and formulating the research question	Stipulates the problem from the task, splits it up in sub-problems or aspects, specifies domains that the problem is related to, names the relevant stakeholders. Describes the problem in a larger framework describes, with relevant references to similar problems. Verifies with the client if the problem has been correctly and entirely described. Formulates the research questions and splits these up in sub-questions. Verifies with the client if the research questions have been correctly and entirely described.	<ol style="list-style-type: none"> <li>1. Examines the task and stipulates the problem - in consultation with the customer</li> <li>2. Differentiates between main and side-issues</li> <li>3. Classifies the problem in several aspects/sub-problems</li> <li>4. Clearly states to which field the different (sub) problems are related</li> <li>5. Provides a clear and complete problem description, based on obtained information.</li> <li>6. Describes the problem in a larger framework</li> <li>7. Describes availability of background information.</li> <li>8. Names relevant stakeholders</li> <li>9. Defines relevant research questions and splits these up in sub-questions</li> <li>10. Verifies research questions with the customer</li> </ol>
1.2.1 Determine methods and techniques	Selects and assesses methods, techniques and materials which can be used in the research implementation. Gives a founded argumentation for the choice of the methods, techniques and materials which will be used in the research.	<ol style="list-style-type: none"> <li>1. Gives an overview of available methods, techniques and materials</li> <li>2. Gives a description of the most important characteristics of the available methods, techniques and materials</li> </ol>

		<p>3. Establishes criteria for the selection of methods, techniques and materials for the research</p> <p>4. Chooses research methods, techniques and materials on the basis of clear arguments</p> <p>5. Explains clearly to third parties how the choice for methods, techniques and materials has come about.</p>
1.3.1 Gathering data	<p>Determines the need for relevant data, like literature and field data for a concise problem situation. Gathers relevant primary and/or secondary data in respect to the solutions to a problem.</p>	<p>1. Determines the need for relevant data (type and quantity) for a concrete problem situation</p> <p>2. Determines if data is already available elsewhere in the correct</p> <p>3. Makes an overview of useful data sources</p> <p>4. Identifies possible lacunas in the required dataset and undertakes action to fill these up</p> <p>5. Verifies if the obtained data are appropriate for the research question</p> <p>6. Discusses with the project members whether the obtained is data satisfactory, and takes the initiative for making agreements on collecting missing data</p>
1.4.1 Process data and analyse	<p>Arranges, classifies, generalises, extrapolates and presents relevant data by (sub)question. Provides links between the collected data. Gives statements concerning the reliability and validity of the data</p>	<p>1. Arranges and classifies the available data</p> <p>2. Generalises the data in a justified manner</p> <p>3. Conducts the extrapolation from the dates in a justified manner</p> <p>4. Presents the data per research question clearly</p>

		<p>and transparent</p> <p>5. Links the collected data</p> <p>6. Gives evidence concerning the reliability and the validity of the data</p>
1.5.1 Drawing conclusions and evaluating	<p>Draws conclusions from the available information. The relevance of the conclusions is placed within the framework of the task as a whole. Advises the client concerning the research results and possible future steps. Indicates social consequences of the outcomes.</p>	<p>1. Draws the correct conclusions based on the collected data</p> <p>2. Reflects on the value of the research outcomes in relation to the task</p> <p>3. When necessary, indicates restrictions of the research outcomes (resulting from available data and/or used methodology) in the light of the concrete problem,</p> <p>4. Provides recommendations to the customer for possible further research</p> <p>5. Indicates the social consequences of the research outcomes.</p>
<b>Group 2: Reporting</b>		
2.1.1 Verbal reporting	<p>Makes ideas and opinions clear to others, using clear language and non-verbal communication. Language and terminology coordinated on the audience. Aimed at smaller (internal) group.</p>	<p>1. Speaks clear and audible</p> <p>2. Formulates clear and in understandable language, coordinated on the target group</p> <p>3. States the aim of the report</p> <p>4. Communicates a complicated problem to others in a logical order</p> <p>5. Uses the correct technical terminology 6.</p>

		Checks if the other has understood the message, examines if there still are obscurities or questions
2.1.2 Reporting in writing	Puts ideas and opinions in writing in understandable and correct language and in a structured manner. Language and terminology are adapted to the reader.	<ol style="list-style-type: none"> <li>1. Provides texts with a clear structure</li> <li>2. Writes grammatically correct, short sentences in understandable language</li> <li>3. Adapts style, word choice and language level to the reader</li> <li>4. The report satisfies the agreed format</li> <li>5. The reported data are accurate, correct and relevant concerning the problem</li> <li>6. The reasoning used is correct</li> </ol>
2.1.3 Editing	Adapting a report or presentation (contributions of others) to improve its intentions, without compromising the substantial message.	<ol style="list-style-type: none"> <li>1. Verifies the structure and legibility of the speech, report or presentation on the basis of the criteria for written reports.</li> <li>2. Reinforces the order by distinguishing in main issues and side-issues</li> <li>3. Checks on style and language</li> <li>4. Verifies the use of univocal terminology</li> <li>5. Pays attention to using lively language</li> <li>6. Incorporates contributions of others in the speech, report or presentation in a such manner that it becomes a whole</li> </ol>
2.1.4 Presenting	Manufacturing of a presentation (aimed at a larger	<ol style="list-style-type: none"> <li>1. Has established a clear speech plan</li> </ol>

	group, with persons of outside the own team) that, on the one hand communicates the message adequately and on the other hand is adjusted to the recipients.	<ol style="list-style-type: none"> <li>2. Makes good use of audiovisual resources</li> <li>3. Speaks clear and quiet, uses clear and lively language.</li> <li>4. Connects to the audience and and maintains the contact</li> <li>5. Anticipates to responses and questions from the public in a correct manner</li> <li>6. Knows how deliver the message well, using lively language</li> </ol>
<b>Group 3: Discussion and collaboration</b>		
3.1.1 Chairing a meeting	Chairing a meeting in such a way that it is efficient (everyone who wants to make a contribution gets its chance, no superfluous digressions) and effective (aims per subject are reached).	<ol style="list-style-type: none"> <li>1. Puts on a clear agenda.</li> <li>2. Ensures that the meeting proceeds clearly and structured, so that everyone gets the time and space to make their contributions</li> <li>3. Monitors the agenda and the time schedule and intervenes if the discussion goes astray or if there is dwelled too much on some subject</li> <li>4. Ensures good and pleasant working environment</li> <li>5. Shortly abstracts the discussion and ensures making clear agreements.</li> </ol>
3.1.2 Taking minutes	Taking minutes of a meeting efficiently (the essence is grasped, superfluous digressions are	<ol style="list-style-type: none"> <li>1. Provides good and clear insight in the matters</li> </ol>

	not) and effectively (participants accept the minutes as an adequate reproduction of the proceedings).	<p>discussed</p> <ol style="list-style-type: none"> <li>2. Uses the standard elements in the minutes (people present, date, items on the agenda, appointments)</li> <li>3. Provides insight in the nature of the meeting (analysing, information transfer, problem solving)</li> <li>4. Has good and correct use of language, to-the-point without unnecessary digressions</li> <li>5. Distinguishes between discussions and agreements in the report</li> </ol>
3.2.1 Collaboration	Contributions to a common result, also when collaboration does not concern a subject that is of direct personal importance.	<ol style="list-style-type: none"> <li>1. Changes earlier personal aims, if this is necessary to reach mutual agreement</li> <li>2. Backs proposals of others, builds on them in order to reach a common goal</li> <li>3. Continues to contribute, also when is there is no personal importance</li> <li>4. Shows commitment for reaching wins/win conclusions</li> <li>5. Helps colleagues, offers support</li> <li>6. Reduces tensions in the team.</li> </ol>
<b>Group 4: Communication</b>		
4.1.1 Acting customer centred	Research wishes and needs of the customer and act accordingly. Anticipate on the needs of the customer and give a high priority to service and	<ol style="list-style-type: none"> <li>1. Aim actions for the completion of the task on the questions and the wishes of the customer</li> <li>2. Acts, as much as possible, from the interests of</li> </ol>

	customer satisfaction.	<p>the customer</p> <ol style="list-style-type: none"> <li>3. Verifies with the customer if all expectations, wishes or needs have been satisfied</li> <li>4. Makes clear appointments with the customer concerning performance and services to provide. Leaves no misunderstandings</li> <li>5. Keeps to the agreements</li> <li>6. Has a service oriented attitude</li> </ol>
4.1.2 Maintaining external contacts	Initiating and maintaining external contacts.	<ol style="list-style-type: none"> <li>1. Contacts the customer when questions and/or obscurities arise on one's own initiative.</li> <li>2. Know who to contact when questions arise</li> <li>3. Has a pleasant and business-like demeanour in contacts</li> <li>4. reacts adequately and swiftly on questions from the customer</li> <li>5. Knows why certain contacts have been made/are being maintained</li> <li>6. Is informed of the results of the contacts for both parties and of the impacts in the longer term</li> </ol>
4.2.1 Communicating inside and outside of the company	Contribute to the distribution of information on activities within the company. Promotion of company-internal - and external communication.	<ol style="list-style-type: none"> <li>1. Analyses the business communication needs</li> <li>2. Determines which types of information are important in the company</li> <li>3. Initiates and takes care of internal and external news bulletins in a clear language</li> </ol>

		<p>4. Determines which internal and external target groups should distinguished</p> <p>5. Involves employees in devising and implementing communication resources</p> <p>6. Makes agreements with employees for composing the information to communicate in mutual consultation</p>
4.2.2 Managing company knowledge	Detect, arrange and make available knowledge that can be useful for current and future company activities; supply company-broad information concerning the present company knowledge.	<p>1. Provides a clear picture of the meaning of company knowledge</p> <p>2. Provides way to detect new company knowledge and stimulates employees in the building up of company knowledge</p> <p>3. Arranges re-usable company knowledge</p> <p>4. Keeps company knowledge up-to-date and archives out-of-date company knowledge</p> <p>5. Makes company knowledge widely available to everyone in the company, in a systematic and synoptic manner</p> <p>6. Stimulates supplying and using of company knowledge by contributions to information about company knowledge</p>
<b>Group 5 Supervision of activities</b>		
5.1.1 Leading a group	Directing and giving aim to a project group	<p>1. Invites team members to give input</p> <p>2. Marks reached successes of the team</p> <p>3. Rises to the needs of the team</p>

5.1	5.2	5.3
5.4	5.5	5.6

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- 4. Ensures clarity of the result to be reached and of everybody's role
- 5. Clearly states what is mutually agreed on, and what is not.
- 6. Reinforces solidarity and promotes team spirit

<p>5.2.2 Guarding progress</p>	<p>Define and implement procedures to secure good progress of processes, tasks and activities of employees; monitor planning, and if necessary swiftly adjust planning and inform the people it concerns.</p>	<ol style="list-style-type: none"> <li>1. Checks progress and project results</li> <li>2. Uses a checklist or calendar</li> <li>3. Inquires on own initiative when work information is late</li> <li>4. Plans measuring moments and uses these to measure progress</li> <li>5. Makes clear follow-up agreements and verifies these at the agreed moment.</li> </ol>
<p>5.3.1 Coaching a fellow worker</p>	<p>Coaching of a student employee in his or her performance in a certain role (for example project leader) or in the development of a chosen competency. Coaching (mentoring) always starts with determining the aim of the coaching route and with making concise agreements about actions to be undertaken. During the coaching route the coach offer the student employee support in performance in order to reach better work results.</p>	<ol style="list-style-type: none"> <li>1. Makes concise agreements about what should be achieved in the coaching route</li> <li>2. Supplies the necessary information</li> <li>3. Is interested and can image oneself in the place of the student employee</li> <li>4. Listens actively and makes the student employee “look into the mirror”</li> <li>5. Makes the student employee reflect by asking questions</li> <li>6. Has patience and permits the student employee to experience his/her own process</li> <li>7. Permits the student employee to go wrong</li> <li>8. Permits the student employee to experiment and learn from errors</li> <li>9. Reinforces the self-confidence of the student employee</li> </ol>

Group 6 Personal additions		
6.x.x <proposal for additional competencies>	<proposed description>	<proposed criteria>

**Table 4:** Overview of soft skills and their assessment criteria

