The Design of the Virtual Company; Synergism of Learning and Working in a Networked Environment

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SUMMARY

This paper describes the characteristics of the Virtual Company, a new educational concept developed within the Open University of the Netherlands. Briefly, the Virtual Company encompasses a learning environment that is strongly modelled after real companies; its virtuality refers to its location in cyberspace. The Virtual Company aims to bridge the current gap between learning and working by situating learning in a real-life business setting. This paper presents the educational philosophy on which the Virtual Company is founded, the components out of which it is built and, finally, it discusses some preliminary results of a pilot run with it.

INTRODUCTION

To an ever diminishing degree, higher education seems to suit the demands of our modern society. Student numbers have become too large for our traditional teaching methods, employers complain about students who allegedly have much theoretical knowledge but little practical capabilities. In addition to this, it won't do any longer to undergo a period of concentrated learning early in one's life, learning has to be life-long in order to cater for society's needs. Various educational solutions for these demands have been tried. Recently, the Open University of the Netherlands introduced the idea of a Virtual Company, i.e. a networked learning environment that closely resembles a real company. Students in the Virtual Company take up professional roles and run the business. However, the Virtual Company should not be mistaken for an extended role-playing game. Such games usually represent self-contained business simulations, as such they are closed-systems. In contrast, the Virtual Company claims to be part of reality, in that it openly interacts with society: Students address real problems, while developing real products and services on behalf of real customers. The Virtual Company concept can be applied in a variety of educational contexts. First, we will go into a description of some general problems in higher education and possible solutions to them. Then we will depict the concept of the Virtual Company and discuss the essential components of its design. Finally, we will touch upon the preliminary results of a pilot with a networked environmental consultancy firm that we set up.

PROBLEMS IN HIGHER EDUCATION

For many years, the quality and effectivity of higher education have been subject of public dispute (Mulders 1995). Employers typically complain that graduates have acquired an overdose of theoretical knowledge not well matched to the working practice. Even worse, graduates seem to lack the skills or competences to apply the acquired knowledge in appropriate and productive ways (Barnett 1994). Graduates, furthermore, seem to maintain a

overromantic view of their future professions, lacking a clear insight in the ways professionals actually function in practice. This state of affairs is obviously undesirable both from an educational and a business perspective.

Another problem present-day higher education has to face, is the increasing numbers of students that have to be served by less and less staff. As a consequence, bulging lecture-halls with hundreds of students are quite common and, we are sure, barely effective. The huge percentages of student drop-outs (see for instance VSNU 1999) may well be the result of this. From a students' point of view, present educational systems are often rigid and uniform, and fail to address individual needs. They obstruct the students' personal and professional development, which easily results in a deficient sense of responsibility, in a lack of self-confidence, and in an ill-developed feel for ethical and historical values.

The educational institutions generally have ignored the demands of employers. And, until quite recently, students weren't even regarded valued customers that could be cherished and listened to. To the extent that the demands of employers are often simplistic and self-serving and to the extent that students have to be taught (rather than teach themselves), the educational institutions have done rightly so. In our opinion, though, by insisting on their pedagogical responsibilities only, quite some educational institution has turned a deaf ear to justified demands from both students and their prospective employers. Of recent, we are witnessing a significant change of hearts and market-orientated attitudes abound. Quality standards and educational innovations have become strategic tools for maintaining or increasing market shares. Indeed, any self-respecting educational institution seems to initiate projects to procure changes and innovations. These include projects for competence-based learning, collaborative learning, and flexible or distance learning, while in many cases the use of computer networks forms a basic precondition.

Present innovations are often fuelled by a strong technology push. This has the inherent danger that mere new technological changes go under the guise of genuine educational innovations. Certainly, a virtual classroom is to be labelled an advanced application and, by its nature, represents an innovation. However, one should realise that the educational model undergoing the technological change doesn't differ functionally nor didactically, nor socially from its traditional counterpart. Yet, by using computer technology, especially the technology of computer networks and the associated software, fundamental new models of teaching or learning have indeed become possible. Various kinds of collaborative work, collective design and shared knowledge for which even no real-life counterparts exist, are coming within reach. As will be explained later, the Virtual Company does represent a fundamental innovation as it combines both a new educational framework and new supportive technologies.

DEMANDS OF SOCIETY

At the turn of the century, science and technology dominate society in an unprecedented way. Activities in any economic sector are highly dependent on the level of knowledge and expertise of employees. Moreover, under the continuous flow of technological innovations, these knowledge and skills become obsolete quickly (see for example http://www.lll.nl , The Lifelong-Learning Initiative of the Dutch Government). Clearly, learning cannot be

restricted to the phase of initial education anymore, rather, it should continue throughout one's entire working life: life-long learning should become the rule, not the exception. Also, the current emphasis on knowledge of facts, corresponding with the classical ideals of erudition and scholarship, should be replaced or at least be augmented by a focus on skills or competences. Professionals should be able to perform well in complex environments in which they are involved in multifaceted processes, easily take up various new problems and co-operate with experts in disparate fields. Society demands competent and flexible team players who are able both to apply and share their expertise in service of shared goals (Walton 1984, Barnett 1994). The need for a different kind of education is reflected in modern company policies that emphasise personnel training and individual development. Employees are considered human capital, and up-to-date knowledge and skills of these human resources are essential preconditions for successful business.

EDUCATIONAL SOLUTIONS

In response to these demands for a better integration of learning and working, educational institutions have adapted their curricula. Although the acquisition of knowledge may still be a main objective, skills training *i.e.* the active manipulation of knowledge within a practical context has become increasingly important. Various well-tried didactic approaches such as problem-based learning (Barrows *et al.,* 1980), the case method (Barnes *et al.,* 1984), situated learning (Brown *et al.,* 1989), apprenticeship learning (Resnick 1988), experiential learning (Kolb 1982, Kolb 1984) and collaborative learning (Duffy 1993) have regained their popularity, as they support both the idea of a rich and complex learning environment and the notion of active, personalised learning. While the incorporation of such alternative approaches has certainly accomplished a better match between supply and demand of graduates, the problem, it seems, is far from being resolved. Most educational contexts are self-contained, closed systems, shielded from the rest of society. It looks as if students are deliberately kept in quarantine until they manage to pass their exams in order to avoid premature contamination with the real, outside world. Is it any wonder that graduates experience a severe shock when they start their working life?

In some cases, however, educational institutions expose their students early on to the world at large, by pairing them off with outside experts. This model of apprenticeship learning is quite costly, as valuable expert time is withdrawn from regular production processes. In practice, this kind of teaching often takes place on the spot, in a highly improvised fashion, by people who often lack the appropriate didactic skills or even the affinity for teaching; on top of this they often have little time available. So frequently, novices are left to their own devices without appropriate guidance or support. Another means of promoting the integration of learning and working is the so-called dual-systems approach. Companies and educational institutes create a system in which learning and working alternate: employees go to school for a few days and for the rest of the week they have (paid) jobs. In The Netherlands, such a dual-systems approach is financially supported by the government. Although the learning and working are supposed to support each other, the dual-systems approach seems to lack genuine integration. The alternation of learning and working effectively underlines their distinctness. This is exacerbated by the fact that each activity is undertaken at a different location, with different cultures and with different people, which hampers the transfer of acquired knowledge to the practical work.

Occasional attempts have been made to truly integrate the learning process in a company-like context. A first example would be the various management-games that abound (Faria 1998). Indeed, such games may produce fascinating and valuable simulations of businesses in action. Unfortunately, they are usually restricted to the domain of business administration, although this need not be a fundamental concern: extensions to other domains and disciplines seem straightforward. A more fundamental concern is their lack of openness. Being games, there are severe constraints to their possible outcomes and to the ways that lead there. Thus society is at best imitated, at worst caricatured. A second example would be a businesslike learning environment that acts as a real company, developing real products and servicing real customers in the outside world. An example would be GipHouse (1997), a software company at the University School of Informatics of the University of Nijmegen (The Netherlands) that combines real business with educational objectives. Here, during their studies, students work together to run a business. A similar approach recently has been chosen by the University of Twente (The Netherlands) with its University Student Enterprise (see http://wwwutnws.utwente.nl/utnieuws/data/33/32/USE.html). The Virtual Company, as described here by us, is yet another example of this approach, although it has some features that set it uniquely apart from the other two.

THE VIRTUAL COMPANY

As indicated, the Virtual Company strives for a full integration of learning and working. The novel aspect, however, is that it attempts to achieve this in a distance education environment. So the company is no longer restricted to a fixed location on the premises of the educational institute. Rather, it is located in cyberspace, *i.e.* mediated via a computer network. It thus combines the flexibility that is so characteristic of distance learning – within limits students are free to choose where to study, when and at what pace – with the desired integration of learning and working. The Virtual Company addresses existing trends, such as networked-enterprises, remote learning, computer-supported collaborative learning, and individualised learning arrangements. A Virtual Company offers a complex and rich environment for competence-based learning. It narrows the gap between theory and practice, supports active learner participation, takes on problem solving in complex environments, supports teamwork, and addresses individual needs. It fosters a relationship between tutors and students that differs significantly from the patterns common in education: not the educators are in control of the Virtual Company, the students run the business. In the Virtual Company students are stimulated to rely on themselves, to act autonomously and responsibly in their confrontation with the complexities of the real world. It is the educator's task to monitor and watch over the efficacy and quality of learning.

In any Virtual Company therefore, three processes should become fully integrated: working, learning, and teaching. By their natures these are different activities that serve different goals. Working, in terms of a business activity, refers to some kind of collective performance to cater for the needs - be it products or services - of external customers. In contrast, a learning process is a highly personal experience, actually located in someone's brain and aimed at achieving or improving individual performances. The teaching process, finally, includes all the activities educators undertake to improve the conditions for learning. The interfaces of the combined processes may easily

be characterised by viewing the Virtual Company as a black box with inputs and outputs.

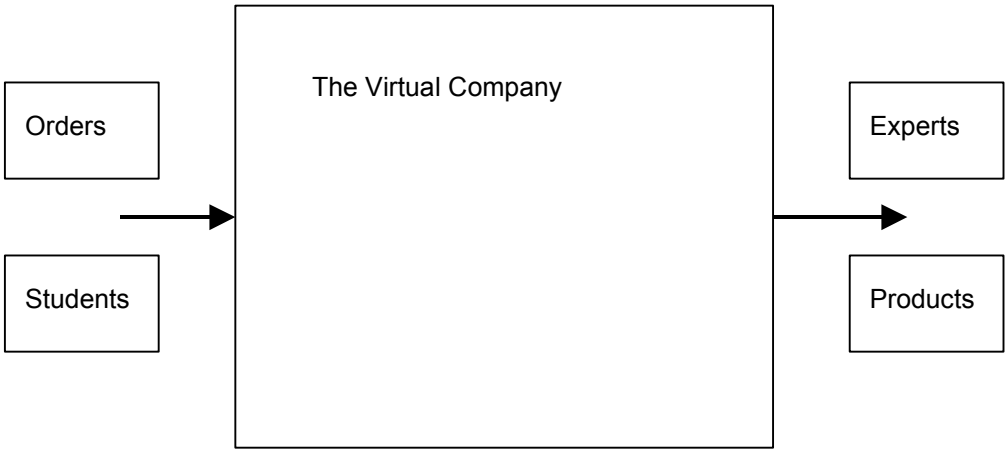

Figure 1 Inputs and outputs of the Virtual Company

Clearly, besides the supply of products and services within a specified domain, the delivery of competent professionals is a productive goal in itself. At first glance, this might look a little strange. However, upon closer inspection, it is clear that competence development fits quite well in a knowledge-centred society. Many real companies have come to realise that competence growth of their staff is a precondition for success. They see employees as human capital, and the development of individual and collective competences as a strategic issue. In this sense, the Virtual Company sets an example in the way it allows its employees to develop themselves.

PROCESSES AND COMPONENTS

In the next sections we will discuss how the Virtual Company manages to achieve this by outlining the basic design of the Virtual Company. First, we shall briefly describe the Virtual Company's core constitutients, then we shall discuss some key roles and functions. For a more extensive description of the philosophy and educational design principles underpinning the Virtual Company we refer to Westera and Sloep (1998). A discussion of some associated dilemmas can be found in Westera (1999).

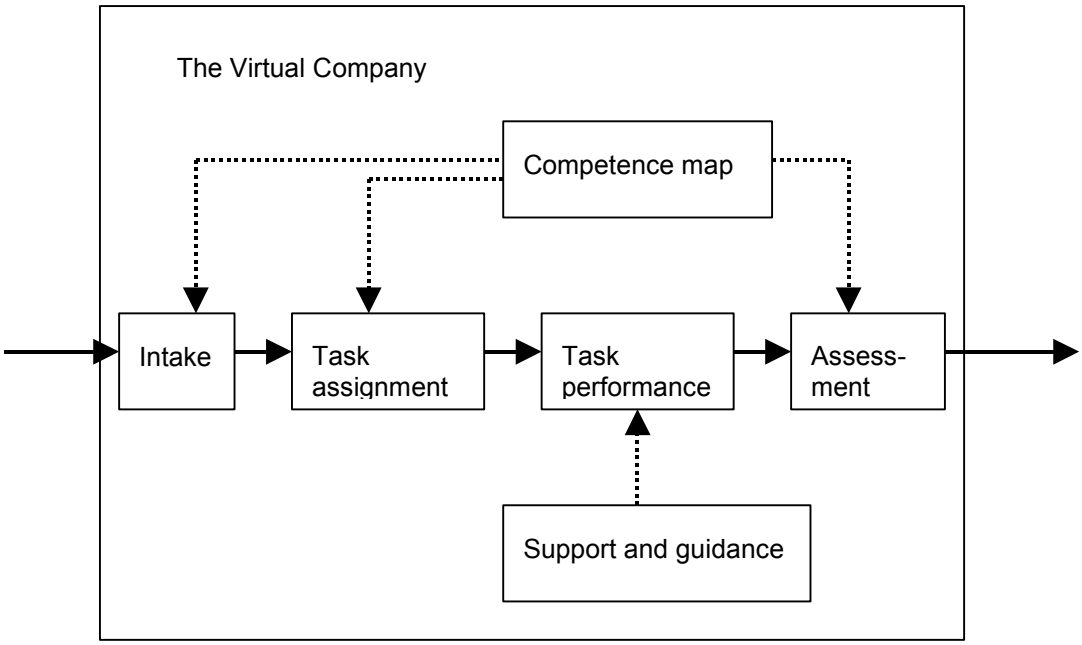

Figure 2 Key processes and components of the Virtual Company

The Competence Map

Within the Virtual Company, all processes are dominated by the concept of competences (cf. Kirschner *et al.,* 1997, Barnett 1994). In any domain to be covered, an exhaustive inventory should be made of competences that are involved in producing the intended products or rendering the projected services. This way a domain-specific and hence company specific competence map is put together. It acts as a frame of reference for all processes involved; it limits the range of products and services and defines the final attainment levels of the educational system.

The Intake

As Figure 1 shows, the intake concerns the intake of both external clients' orders and new students. New orders are mapped into the competence map, to allow for a decision on their acceptance. Only orders that require for their completion competences afforded by the company at large, are admitted. Once accepted, an order is decomposed into a number of distinct tasks that can be distributed over individual students who are organised in project teams or departments, whatever the organisational model used. Each task is labelled with a specified competence profile and associated performance levels, as derived from the competence map. The intake of new students shows a similar pattern, although a different set of instruments is applied. New students are diagnosed so as to disclose their learning needs, their ambitions and their capabilities. In some cases, the intake procedure may even be similar to a regular selection procedure, including an interview with the current employees of the Virtual Company (allowing active students to acquire recruiting competences).

Clearly, educational staff will guard the quality of the intake process. Competences and performance levels of new students should be established and mapped against the competence map. In the resulting student's profile, competence gaps are the starting point for assigning sensible tasks from the stack of standing orders. For each student, the intake process results in a document that represents his or her career plan. This plan provides an overview of the student's educational objectives and it anticipates ways to achieve those. To a certain extent, the career plan may be compared with a traditional yet personalised curriculum: it provides a baseline for the long term, while it counters *ad hoc* decisions.

The Task Assignment

The intake process thus produces a pool of tasks with specified competence requirements on the one hand and a list of students labelled with specified learning needs – competence gaps – on the other hand. By comparing requirements with needs, students are allocated appropriate tasks. In actual practice, this task assignment can be quite a puzzle. First, any business order is only brought to production, if all distinct tasks that make up the order, can be carried out. Second, customers of the Virtual Company will probably claim some deadline for completion of the final product. Third, collaborative work sets extra demands to the student's availability and pacing. Fourth, unlike regular educational systems, the Virtual Company does not necessarily support the idea of a regular, periodic influx of student groups (cohorts); *ad hoc* task assignment to a new individual, can be quite troublesome. Fifth, tasks can be carried out only if they fit in the student's career plan. Finally and most importantly, the ultimate allocation of tasks to students is an optimisation problem, which are notoriously difficult to solve. Usually, it is impossible to ascertain that the optimal solution has been found and one has to settle for near-optimality. Of course, this may well suffice.

Note that this task assignment strategy primarily aims at filling the competence gaps of workers. It thus is quite hazardous in terms of overall business success. While it prevents the employees from performing routine jobs, it principally advocates the idea of incompetence at work. By no means, this strategy of the Virtual Company should be equated with throwing students in at the deep end to have them experience how tough and complex reality is. Any task carries with it a set of minimum requirements, in terms of antecedent knowledge and skills. According to the career plan, students will be assigned only to those tasks that match their capabilities. That is, tasks become only gradually more complex so as to allow the students to improve their performances step by step. Moreover, the Virtual Company is supposed to be a learning environment exhibiting an adequate system for guidance and support. This prevents the quality of products and services widely to miss the mark.

Support and Guidance Structure

In the Virtual Company, students are immersed in an environment with a natural complexity that forces them to act in an autonomous, explorative way. The strength of such experiential learning lies in the acquisition of informal knowledge. Such knowledge is highly associated with the way individuals interact with their environment; it cannot be expressed precisely in texts or in any other (formal) symbol system (DiSessa 1977, Kolb 1982). This tacit or implicit knowledge makes up quite a substantial part of human

competences. Yet, experiential learning is less than adequate when it comes to the acquisition of formal knowledge and theories. It would be quite unlikely for students to discover single-handedly Newton's theory. And if they could, it would no doubt take quite some time (Ausubel, 1968). Experiential learning also falls short when skills or competences are required for which there have been no opportunities to practice. Swimming can hardly be learned effectively by being thrown in at the deep end, literally. So students in the Virtual Company should be given the opportunities to prepare for their business tasks. Therefore, a substantial *support and guidance structure* is available, which includes relevant sources of information, appropriate instructional materials, individual coaching and extensive training facilities.

This should not be mistaken for the reinstatement of a standard school structure within the confinements of the Virtual Company and thus the re-establishment of the separation of learning and working. In contrast, explicit learning activities are only directly associated with and evoked by the regular business tasks. This just-in-time learning is assumed to be highly motivating and provokes learning and working to fuse. Needless to say, the support structure is not limited to educational materials only. It also includes standard elements of a business information system such as tools for project management and accounting, information collected in past projects including final reports, customer records, materials for public relations, house regulations, etc. And, in line with the philosophy of openness of the Virtual Company, the information system provides a window to the world outside the company. More specifically, students may check out public databases, the Internet at large, and even consult selected experts in the field through e-mail. Occasionally, even students in the Virtual Company may adopt the role of internal expert who may be consulted by fellow students (peer learning). Of course, it is the job of the business information system to make the availability of such expertise transparent to the rest of the company.

Quality Assessment

Despite their integration, the lay-out of the business processes (rendering products and services) will be quite different from the arrangement of the educational process (producing competent students). Consequently, quality assessment in the Virtual Company comes in two different kinds: quality assessment of the business process and quality assessment of the educational process. The lay-out of the business processes is highly dependent on the domain chosen and calls for domain-dependent methodologies and instrumentation. Obviously, as part of their competence learning, students may well take part in this kind of quality assessment activities. As business quality as such is no business of the educator, we will not go into it any further.

On the other hand, the quality of the educational process is the educator’s key responsibility. The educators should secure the effectivity of learning and the performance levels of students. Here, educators may face a serious problem, inclined as they are to manage and control the whole system and to step in when things seem to go wrong. Should they disregard what they may see as their primary tasks and responsibilities and sit by and watch the student’s plodding? To a large extent they should indeed. Rather than stick with the traditional patterns, in our view educators in the Virtual Company should adopt the constructivist stance of relying on learner control, self-confidence and collaborative processes. Efforts to improve the effectiveness and quality of the learning process should as much as possible be directed

towards improving the support structure and should only very rarely take the form of direct interventions.

This does in no way detract from the necessity that the Virtual Company's graduates meet legally recognised performance standards. Therefore, in the Virtual Company an extensive student monitoring and assessment system is established (indeed, the intake also forms part of it). The performance assessment includes traditional teacher controlled evaluation procedures as well as methods for self- and peer-assessment by the students themselves (Sluijsmans *et al.,* 1998). The latter are used to assess the individual's informal knowledge and functioning. All documents produced in the course of one's career - *i.e.* results of assessments along with reports and papers produced on behalf of customers, etc. - are collected in a personal port-folio that forms the basis of establishing and formalising performance levels. By asking the customers to assess the final report's merit in relation to the order originally submitted by them, an external assessment of the student's work is made. This too may be incorporated in the portfolio. Collectively these assessments also reflect on the effectiveness and the quality of the teaching of the entire learning environment. For instance, if customers are systematically dissatisfied with the quality of the students' work, one or more of the Virtual Company's core components should be scrutinised for flaws. Is the competence map adequate, does the intake sufficiently gauge a student's capabilities, do students get assigned fitting tasks, does the support structure function properly? Asking these and similar questions helps improve the educational quality.

So interestingly, quality in business terms and educational quality are not entirely unrelated. An extensive description and evaluation of this set of assessment tools and the associated procedures is to be published elsewhere (Sloep *et al.,* 1999).

ACTORS: ROLES AND FUNCTIONS

Various people with a variety of functional roles take part in the Virtual Company. Figure 3 depicts these roles, while the perspective of some team 1 has been adopted. Each student then is part of a team; team members have different roles. They may for instance be a project manager, an account manager, a content expert, etc. To complete agreed tasks and realise requested products and services, students within teams will have to work together frequently. To a lesser extent this also holds for students across teams. The exact roles and positions of teams will be dependent on the chosen organisational model: teams may be business units, departments, sections, project teams, work groups, etc.

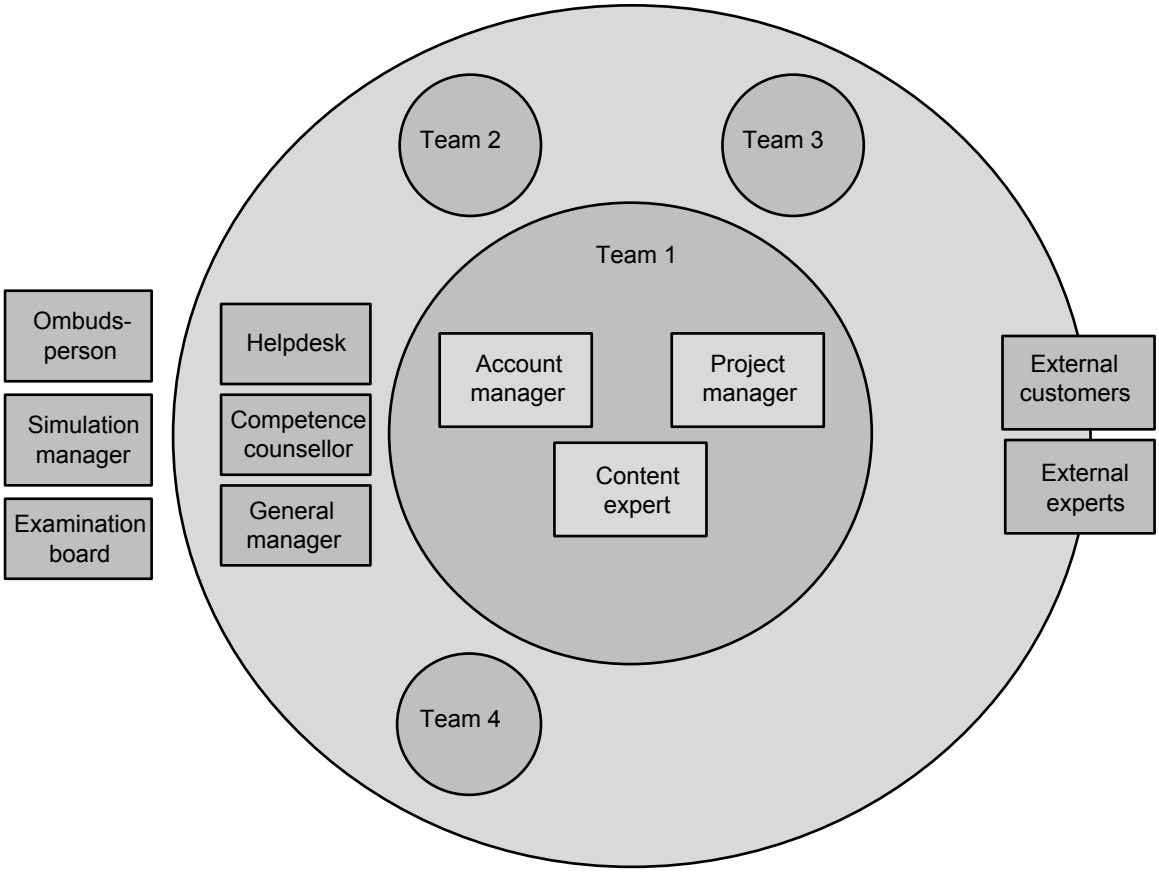

Figure 3 Actors in the Virtual Company as seen from the perspective of team 1.

The educational institution has a number of functions to fulfil. It offers competence counselling, it certifies student achievements, it manages the Virtual Company, it provides an ombudsperson. Competence counselling is conducted by competence counsellors; they belong to the Virtual Company staff. They are responsible for the student intake, monitoring and assessment. They put together and monitor the individual students' career plans and are chiefly responsible for the students' task assignments. In fact, the educational institution's responsibility that students actually learn something is put in their hands.

Certificates are awarded under the responsibility of an examination board. Obviously, the board is an agency that resides outside of the Virtual Company. The board awards certificates on the basis of an inspection of student portfolios and, if necessary, interviews with a students competence counsellor.

The Virtual Company needs to be managed. There are two different managing roles to be distinguished, one that needs to be performed by the educational institution, another that may either be performed by the educational institution or by one ore more students. To start with the latter role: the Virtual Company must obviously be a viable working environment, a (moderately) successful business. This kind of management will be done by the general manager. He or she may well be a student, although it is probably wise, at least initially, to have an experienced educator play this role. With the maturation of the company, perhaps qualified students could take up management roles. Whether this is a viable option will also depend

on the kind of company and the kind of students that are attracted. Note that having students play management roles will demand an extension of the competence map.
In addition to managing the business, the educational institution has to make sure that the Virtual Company remains a viable learning environment. This role of simulation management essentially cannot be delegated to students because it is intimately tied to the institutions educational responsibilities. Whenever anything occurs that threatens the Virtual Company's proper functioning as a business based learning environment – either as a consequence of design flaws or as a consequence of undesirable employee behaviour – the simulation manager should intervene.

Important though management is, employees (all, not just the students) will have also sorts of rather practical questions about the Virtual Company: questions about hardware failures and compatibilities, software needs and problems, etc. That's where the helpdesk officer comes in. The helpdesk officer may be regarded the company's odd jobber. This role is of crucial importance for a smooth operation of any Virtual Company.

Once in a while, student employees may experience problems during their stay in the Virtual Company. Problems may regard their unease with the novel learning environment and its rules, with their colleagues, both fellow students and staff, or with the tasks they have been set. Though in principle, such problems should be solved within the confines of the Virtual Company, it sometimes may be necessary for students to consult an outsider, who has no stakes in the company. Therefore, the model is extended with an ombudsperson who actually functions as an independent trouble-shooter and who allows students temporarily to step out off the 'business' and find solutions that cannot be found within the confines of the Virtual Company itself.

A PILOT STUDY

To test the validity and feasibility of the Virtual Company as a learning environment, an experiment was carried out. The pilot, arranged in the first part of 1998, was situated in the domain of environmental consultancy. In this paper, we confine ourselves to a brief discussion of the experiment; a more elaborate discussion will be published elsewhere (Sloep *et al*., 1999; see also http://www.ou.nl/vb/). Before allowing students to start work for the Virtual Company, the development team prepared the grounds for them. First, a competence map was constructed. Also, a backlog of orders was prepared by approaching various third parties that could act as customers. Next, a decomposition of these orders was carried out to arrive at a set of distinct tasks with labelled profiles of required competences. The pilot company was called InCompany Environmental Consult. A business model was developed, including a mission statement, a business philosophy, a range of products, an organisational structure (project organisation), job descriptions, house regulations, and a support structure, containing archives, references to relevant literature and available experts, instructional materials (fact sheets) and training facilities. The experiment was carried out with 14 senior students of the Environmental Science Program of the Open University of the Netherlands. For the duration of the experiment, each student received a fast PC on loan, that could be linked to the company server via a 64 kbit/s ISDN connection. The set-up allowed for both synchronous and a-synchronous communication between employees.

The experiment was kicked off by a plenary (face-to-face) session which had the dual function of explaining the intentions and objectives of the experiment and giving the future team members an opportunity to meet in person. It was also meant to introduce the various forms of computer-mediated communication the students were going to use. Three competence counsellors carried out the intake, which comprised an interview and the filling out of a questionnaire. After having established the student's competence profiles and learning needs, they were allocated to one of four project teams. Each team worked on a different order. During the experiment, individual students conferred regularly with their competence counsellor to evaluate their functioning and their performance levels. The four project managers - also students - regularly reported the state of affairs to the general manager. After 10 weeks (effectively about 120 hours of study load) the experiment was concluded with a second plenary session in which the teams presented their final products to the other teams, the customers involved and development team. Shortly thereafter, the examiner evaluated the students' portfolios and performed the final assessment.

PRELIMINARY RESULTS

A significant observation during this first pilot study has been that students showed high levels of motivation and commitment. Students indicated to enjoy the thrill of reality in their contacts with real customers, the confrontation with real problems and the search for real solutions. The artificial closing down of the Virtual Company by the end of the pilot, met with quite some objections from the students, who still wanted to improve their final products. Yet, certain aspects of this first Virtual Company proved to be delicate.

Students indicated that, at the start, they were overwhelmed by the amount of information, for instance, the house regulations, internal procedures, the applied technology, assessment tools, etc. Also, inter-team communication was quite uncommon, the bulk of the interactions occurring within the teams. According to the students, this segmentation caused a lack of corporate company feeling or corporate company culture; it enhanced the idea of isolated projects. Students as well as competence counsellors were reportedly confused over their various tasks and roles. Indeed, the competence counsellors roles were likely to overlap with those of external domain experts, because any one of them also happened to be an expert in the domain of environmental consultancy.

It would be cynical to state that the observed confusion is an inevitable, perhaps even desirable artefact of introducing reality. Indeed, like any real organisation the Virtual Company shows failings and shortcomings. One might urge in excuse that this particular Virtual Company was jump-started, it lacked a history, a shared culture and common behavioural patterns, and it left students little to no time to get acquainted to this novel way of studying. Yet, behind these operational problems lie some more fundamental questions.

Students wondered who was in charge. What character represented and personified the Virtual Company's identity? Why wasn't there some kind of central mechanism for management and control to counterbalance the students' autonomies? Clearly, in the next experiments the corporate identity as well as the internal communication structure are to be improved upon. Second, the process of task assignment turned out to be quite troublesome. The small number of students and the small number of orders stood in the

way of making good matches. Occasionally, students had to work on tasks that didn't sufficiently match their learning objectives. Third, it was concluded that the intake process should have tested more explicitly for available knowledge and skills. Fourth, the underlying competence map should have been developed to a more operational level. Fifth, students reported that the procedures for self- and peer-assessment were quite time-consuming. Interestingly, they used a professional argument: why assessing my colleagues when my customer is waiting? Consequently, the assessment of competences, while using incomplete portfolios, was quite difficult. Here again, intentions and meanings of the procedures should have been better communicated.

Weren't there any technical problems, one may wonder. Technology as such, was no primary concern in this first pilot. The Virtual Company is primarily a conceptual model for the integration of learning and working. Its design should therefore preferably be independent of a particular technology. Having said that, computer-mediated communication via the Internet, using the various existing, standardised protocols would be an obvious candidate technology for collaborate work. In the present pilot, the Virtual Company used off-the-shelf software, based on TCP/IP standards. And indeed, initially technology was a cause of problems. During the first few weeks the helpdesk officer had to make substantial overtime to get the students up and running. Luckily, after the initial few weeks of troubles, most technical problems had been overcome. Indeed, in retrospect it is quite surprising to note how easily and quickly the inexperienced Internet users that most students were, had managed to find their way around. And after the pilot, most students characterised networked communication as a very promising way to combine collaborative learning and distance education. This conclusion may however be somewhat biased. The evaluation revealed, that at least one of the students motives to participate in the pilot study was exactly to get acquainted with this kind of communication. In contrast, a student control group turned out to be much more sceptical about the possibilities of computer mediated communication and showed only little interest in the subject.

CONCLUSIONS AND PROSPECTS

In our view, this first experiment has shown that the Virtual Company *qua* innovative learning and teaching environment holds many promises. On the whole, the idea of competence learning in a virtual company seems to work quite well. In the course of 1999 follow-up experiments are planned. These focus on a variety of aspects, such as the development of better means of preparing competence maps, the improvement of the assessment system as well as the guidance and support structure. Also, software better geared to support the envisaged networked, collaborative learning environment, will be used. Furthermore, while the Virtual Company is associated with the idea of life-long learning and the integration of learning and working, the Open University of the Netherlands aims to start partnerships with real companies, to test the validity and applicability of Virtual Company in different contexts. Corporate training – *i.e.* a Virtual Company located entirely outside academia and squarely inside a company's human resource management structure - is an obvious candidate. Thinking further along these lines, one may contemplate the use of Virtual Companies for organisational prototyping – testing out organisational reorganisations in a relatively safe environment – or the incorporation of explicit knowledge management structures and strategies in knowledge intensive enterprises and institutions. Ultimately, the

project aims to develop an extensive set of methods and tools to set up and run a variety of virtual companies, both in higher education and corporate environments.

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