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Task-Based Team Learning with ICT, Design and Development of New Learning

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Abstract

There is a shift going on in Dutch higher education from traditional, teacher centred education to student learning activities. The trend is to structure these activities in real-life tasks, projects or case situations in which Information and Communication Technology (ICT) is integrated.

This paper discusses results of a two-year project implementing this type of education. The focus of the project was on task-based team learning with Information and Communication Technology. In this project two Dutch universities worked together. One partner was the Hogeschool van Utrecht, a university for applied science and professional development. The other was the University of Utrecht, a general university. A large department and an educational expert centre were involved in each university. Learning environments were developed in two settings: Economics and Management (Hogeschool van Utrecht) and Medicine (University of Utrecht).

An example of a task-based team learning environment is described. It is a course on E-business of 280 hours of study for part-time students in Economics and Management. The didactical model of task-based team learning underlying this course is presented. The results confirm that the model is relevant and useful.

In an analytic part of the project good practice for design, development and implementation was identified from literature and assembled in two sets of guidelines, one design of task-based team learning with ICT and one for development and implementation. Substantial implementations of new learning imply changes in the organisation of education, the roles of students and teaching staff, and the infrastructure. Because of this, the design and development process become complex activities and have to be split into sub-processes for effectiveness. A process model for design, development and implementation was therefore introduced in the project and is presented here.

The developed guidelines were reviewed with respect to (critical) success factors contributing to success or failure of the courses developed. There are always risks in course design and development, and specifically so in task-based team learning, because students have an explicit responsibility for their own activities. What are then the essential factors decisive for success or failure of design, development and the running of such courses? Design and development guidelines were reviewed to identify success factors and the actors involved. Some of these success factors were deemed to be critical, others non-critical. In the last stage of the project these success factors were validated with experienced designers and developers. Some examples are presented.

Keywords: new learning, multidisciplinary, team work, innovation, success factors

1. Introduction

There is a shift going on in Dutch higher education from traditional, teacher centred education to organisation of student learning activities. The trend is to structure these activities in

real-life tasks, projects or case situations in which Information and Communication Technology (ICT) is integrated. In a recent report to the Dutch government, "About old and new knowledge: Implications of ICT for the policy on knowledge", the Scientific Board for Government Policies, states (Wetenschappelijke Raad voor het Regeringsbeleid, 2002, p. 153; authors' translation): "Currently there is a shift in focus in education from factual knowledge to the development of competences. Although development of factual knowledge will remain an important aim, there is growing importance attached to the ability of actively mastering knowledge in a practical context and of translating knowledge to a specific context. Implication for the didactical model is that emphasis is put on an active, individualised learning process in a rich and complex learning environment. This learning should prepare individuals so that they are able to function in complex environments in society and/or business. In these complex environments they will be confronted with a multidisciplinary approach to questions, a diversity of new questions and cooperation with experts form various domains. In comparison with traditional, factual knowledge oriented education the emphasis of competence aimed education is more on roles, tasks and problems that a graduate should be able to fulfil, execute or solve" (Jochems and Gerrissen, 2000; Westera *et al.*, 2000). The observed shift in didactical model, aiming to prepare individuals for functioning in complex environments in society and/or business, implies, next to emphasis on roles, tasks and problems, emphasis on learning in (multidisciplinary) teams and support by ICT. The didactical models used in the project reported in this paper are based on these three principles. Different didactical models based on these three principles were used in the two disciplinary domains. The domain of Economics and Management finds its place in a professional university (Hogeschool van Utrecht). The other domain of Medicine (University Medical Centre Utrecht) finds its place in a traditional university (University of Utrecht). Implementation of the didactical models was supported and monitored by educational expert centres: Cetis (Hogeschool van Utrecht) and IVLOS (University of Utrecht).

The project affected a substantial part of the educational programmes, implying substantial curricular redesign. The size of the project (a two year project with a budget of 1 million Euro) is an illustration of the substance of the innovation. The project was partially funded by SURF Educatie⟨F⟩, a Dutch higher education programme supporting substantial innovations with ICT at curriculum level.

2. Task-Based Team Learning with ICT

We have based task-based team learning on three principles which are discussed in the following sections. Courses developed in the project therefore share particular characteristics.

2.1. Task-based learning

The principle of task-based learning reflects the decisive shift in the innovation reported here. It puts emphasis on an active, individualised learning process in a rich and complex

learning environment. Task-based learning implies that students work on sizable assignments, real-life tasks, with a concrete result. The size and character of the assignments makes working in teams, the second principle of the didactical models, a more or less natural situation.

Task-based learning aims to make graduates capable to deal with changes in their future working and professional environment (van Weert, 2001a):

- societal changes in the direction of knowledge work in the 'Information Society',
- the change from using disciplinary facts to competence based working,
- the growing importance of the integration of knowledge, skills and attitudes across the borders of separate disciplines,
- the emphasis put on meta-cognitive competences and 'Tacit Knowledge'.

In professional practice a switch is being made from job-based to competence-based (Lawler, 1994). The tasks of the professional have become more complex and involve both disciplinary and other competences. In task-based learning students work on tasks with a clear relation to professional practice: student tasks are modelled after complex tasks of the professionals. For some courses this relation is more explicit than for others. However, tasks can be identified which are characteristic for the professional researcher, the professional designer, the professional consultant, etc. These tasks are translated into student tasks. The domain may differ: research in Physics, design in Informatics, others in medical care or business consultancy.

Professional practice asks for graduates who have the basic competences to function as a starting professional. These basic competences then are further developed in a process of lifelong learning and adapted to the working environment. Traditional knowledge 'know what' is not sufficient in the dynamic working situations of today. Knowledge has to be enhanced with 'know how', 'know why' and 'care why' (Duffy and Orrill, 2001). Students have to develop the competences which are necessary to operate in an adequate way. A good way to do this is in authentic, realistic learning situations, because students need a learning environment in which they can learn to operate at the level required for starting a professional career. Quality results can be obtained when this learning environment takes realistic account of the future working and professional environment: the tasks students learn to perform have to be realistic. In task-based learning the student role is defined as that of a junior professional. Research shows, see for example (Jonassen, 1997), that tasks performed in authentic situations lead to better understanding and transfer. Condition is that the complex character of the authentic situation is preserved in task performance. Task-based learning is closely connected with concepts as 'Learning by experience', 'Active learning' or 'New learning' (Simons *et al.*, 2000), but also 'Constructivist learning' (Duffy *et al.*, 1993; Jonassen *et al.*, 1999).

2.2. Team learning

The second principle in the didactical model, working and learning in teams, is also associated with societal developments. Professional situations more and more demand abilities

for communication and co-operation in teams. Students have to learn to distribute tasks among themselves, to take responsibility, not only for personal success, but also for the success of the whole team. Teamwork allows students to work on tasks, which are sizable and more real-life (more authentic). Team learning also has positive consequences for application of disciplinary content. Verbalisation supports the learning processes: students learn a lot from explaining to each other and from giving feedback on each others results.

The ideas behind Team learning are closely connected to the ideas of cooperative and collaborative learning of Johnson and Johnson (1994a), Kagan (1994) and of 'situated learning' (Lave and Wenger, 1991; McLellan, 1995). The interaction of learners in a 'community of practice' with shared norms, values and attitudes is central in this concept. This in its turn is closely connected to the social development theory of Vygotsky (1978).

2.3. ICT-support

The third principle in the didactical model is to use Information and Communication Technology (ICT) in a mature, professional way where this use is relevant and clearly has added value. This principle is based on the observation that Information and Communication Technology must be mastered by all generations and that it is becoming an ubiquitous tool in the working situation. "The penetration of ICT may have far reaching consequences for the labour organisation and the demands put on the workers. Just as other technological innovations have done in the past, ICT influences commercial organisations in three ways: by product innovation, by innovation of the production process and by changes in the organisation of labour." (Wetenschappelijke Raad voor het Regeringsbeleid, 2002, p. 146; authors' translation.) As part of their professional environment graduates will find generic ICT-tools, like e-mail, browser, text processor and groupware. But also discipline specific tools, like Mathematica and SPSS, or profession specific tools, such as a patient database. It is natural to use these ICT tools integrated in the authentic situations of task-based team learning.

But ICT also plays a role in learning as such, and specifically in situated learning where the social context is important. The current desktop technology provides a powerful toolbox for support of situated learning (van Weert, 2002a, p. 23). What is needed is an effective organisation of its use and not so much more technology. There is no need for elaborate electronic learning environments for ICT to be effective in situated learning. The important ICT applications deal with the functions communication (finding and interacting with resources, organisations and people), organisation (organising and synchronising tasks, calendar and resource management) and knowledge management (organising, storing, creating and sharing of knowledge). These applications can be used at the university, in the home or at any other location providing access, including mobile devices. The use of the applications can be individual or be in groups, anywhere, anytime, to meet ongoing needs.

Our conclusion therefore is that team learning has to be supported by groupware tools (for example a good e-mail programme, MS-Outlook or Lotus Notes) supporting the team process in which communication and co-operation with peers and team members, coaches

and the authentic environment (the customer) is central. Students also should have available tools to enhance their personal planning and productivity (for example an Office Suite). And students must be able to search for information in digital sources and to use expert information available through the Internet. And of course students need access to the ICT-tools commonly used in the particular professional field.

In task-based team learning with ICT it is essential that use of ICT is a necessity for effective performance. If students perceive use of ICT as forced, in task performance or in team support, they will do without. Design of task-based team learning situations should take account of this, it is a critical success factor in the design.

2.4. Resulting course characteristics

Task-based team learning with ICT has been based on three principles: real life task performance, learning in (multidisciplinary) teams and support by ICT. Various didactical models can be designed on the basis of these three principles (van Eijl *et al.*, 2001). Common characteristic of the courses developed in this project was that students were invited to be active, to be productive and to be creative. There was much room for students to show initiative and to develop a mature attitude. Motivation, both of the student and the educational organisation, was a driving force. The aim of the developed courses was to stimulate students to develop general, professional as well as personal competences. Competence is defined here as the capability to apply combinations of skills (associated with underlying knowledge) effectively and efficiently in professional situations. The traditional, more or less exclusive, focus on content was changed to a focus on the organisation of learning activities.

3. An Example: Course on E-Business

In the following sections we discuss design, development and evaluation of a particular course in the domain of Economics and Management.

3.1. Sharing of responsibilities

The courses developed in the project, both in the domain of Economics and Management and the in the domain of Medicine, specifically had the aim to bring professional practice into education, both in methodology and required results. In the development of this course on E-business it was observed that professionals in innovative practice will have a say in which method will be used, and in the specification of the result criteria. Therefore students are also invited to formulate what criteria will apply to the way of working (method) and what criteria will apply for the result to be gained. Of course convincing arguments have to be given for the selection of method and result criteria. When making choices with respect to process or result students account themselves against these criteria.

The approach in the design of the course was one of 'shared responsibilities'. In the learning situation three parties shared responsibilities: a student (in a team), a teacher/coach and an expert from the professional field. As this was an innovative learning situation all concerned developed competence and expertise, both their own and those of their peers (Hezemans and Ritzen, 2002).

3.2. Course setting

The course was realised in the setting of a Faculty of Economics and Management (3000 students) of the 'Hogeschool van Utrecht', a university for professional development and applied science. It was one of three courses (modules) developed in the project. The courses were developed for part-time students following one of five part-time, four-year studies (Business Economics; Commercial Economics; Business Informatics; Management Economics and Law; Logistics and Economics). The courses are competence oriented and multi-disciplinary, and therefore open to students from all five part-time studies. Each course requires students to invest 280 study hours.

3.3. Design choices

In the course on 'E-commerce' several parties were involved:

- third year students from five different part-time studies (about 100 students),
- a development team of teachers (5 persons) and a support team of teachers (7 persons),
- an expert from professional practice (Service Line Manager, Business Consulting, Oracle BV Netherlands),
- customers from the business world wanting concrete advice on how to use E-commerce in their business.

In consistence with the concept of task-based team learning with ICT three design choices were made:

(1) The learning situation is modelled after professional practice. This implies that the learning tasks have to allow students to tackle and solve problems from professional practice using a professional, task based method.
(2) The learning situation deals with a multi-disciplinary problem. This implies that there are varied learning tasks for students from five different disciplinary backgrounds and team work is needed.
(3) ICT use is focussed on supporting interaction and communication between students, teachers and outside professional practice. Students have access to the project materials in a digital (learning) environment allowing time and place independent access by all involved. Selected information and created documents are shared. In addition office tools like text processing tools, spreadsheet, web browser and email software, are used.

3.4. The problem area

E-commerce can be seen as the whole of electronically executed business actions (by businesses, organisations, consumers and public authorities) aimed at enhancing efficiency and efficacy of market and business processes (Dutch Ministry of Economic Affairs). These processes are both internal business processes and processes of interaction with third parties. Not only are transaction processes (such as buying and selling) part of E-commerce, but also processes preceding these transaction processes (such as marketing and market research) and following these transaction processes (such as billing, distribution and after sales).

An informed decision on the feasibility of E-commerce for the business or organisation has to be based on a business plan in which all the above mentioned processes are reviewed. This business plan is the basis on which management can decide whether E-commerce is efficient, effective and feasible.

3.5. Course development

The course was developed in a project format. The overall task set for the students was to develop a business plan on which the management of a real company or branch of a company can decide to opt for E-business/E-commerce activities or not. Preferably this business plan was developed for one of the companies where one of the part-time students in the team worked. As a first step in the project the team of students had to produce an action plan that they had to get agreement on from the customer. The students had to use a strategic approach. The proposed E-business innovation had to be founded on or had to give evidence of well developed policies.

Criteria were developed for both working process and results. These criteria concerned:

- business plan,
- innovation definition (analysis and choice of E-commerce strategy) in the business plan,
- working method used,
- work process.

The criteria for business plan and innovation definition were developed in co-operation with an external expert (Service Line Manager, Business Consulting, Oracle Nederland BV). As an example we give the criteria for the choice of E-commerce strategy (Table 1), which in fact are meta-criteria to be turned by the student team into specific criteria geared to the actual situation.

3.6. Assessment of student competence

In each part-time study in Economics and Management a standard component deals with the work experience students bring with them. Students were asked to create a Personal Development Plan, which takes account of their work experience, dealing with:

Table 1. Criteria for the choice of E-commerce strategy

- Different ideas are presented and a vision is formulated; ideas and vision are analysed with respect to suitability, feasibility and realisation. In this analysis internal and external needs of competitors and buying parties are taken into account, as well as the acceptance by the own organisation and external stakeholders.
- The reasoning takes account of:
  - the main critical risk factors, and their weight and measurability,
  - cost versus benefits (in relation to the current situation),
  - feasibility of implementation in the organisation,
  - technical implementation.
- The final choice of strategy is presented in a reasoned way on the basis of the analysis and the vision developed.

Table 2. Excerpt from the E-business course student manual

Coaching
This project is designed in such a way that you have all the information you and your team need to complete the project on your own. You may work whenever it suits you and your team, as long as the deadlines are met. The project coach is available for support, either in a personal meeting (to be arranged), by email or by communication in the digital learning environment. You need feedback of the project coach on at least the following mile stone results: Vision; Analysis; Strategic Choice and Advise for Implementation. Feedback will be given on the basis of the agreed criteria. If you wish, the coach can also give feedback on other results; feedback will be available within five working days.

Assessment
The final assessment is done on two results: Validated Action Plan and Business Plan. You can find the criteria for both results in the digital learning environment. Also the schedule for delivery of mile stone results is given in the digital learning environment. Mile stone results are: Vision; Analysis; Strategic Choice; Advise for Implementation. Feedback is on the basis of the criteria published in the digital learning environment. The assessment is either 'Pass' or 'Fail'. In the case of 'Fail' you will get feedback on how to improve your result. All mile stone results are part of the final result: the Business Plan. Again you can find the criteria for this final result in the digital learning environment. When both the validated Action Plan and the Business Plan have been assessed as 'Pass', your team will have earned credits for the course.

- professional and business creativity,
- co-operation skills,
- sensitivity for developments in the market and the business environment,
- problem analysis competence and decision making,
- oral and written communication.

This Personal Development Plan was used to assess student performance during the E-business project. Assessment was done as peer assessment, expert or customer assessment or project coach assessment. As an illustration we reproduce part of the student manual in Table 2.

The final assessment of the E-business project had two components:

(1) An assessment of the E-business plan, developed by the team of students, against the agreed result criteria (see the section on course development).
(2) An assessment of developed student competences against overall study programme criteria and the criteria in the Personal Development Plan.

These assessments are preferably done at different points in time, so as not to mix team and individual achievements. The final assessment of the E-business course is organised in the following way:

- the student team presents the main conclusions and arguments of the E-business plan to an audience of customer(s), external expert and project coaches,
- feedback is given by customer(s), external expert and project coaches.

4. Review of Results and Didactical Issues

Our overall conclusion is that the principles underlying task-based team learning with ICT provide a basis for successful course design and development. There are several didactical issues we have found to be of particular importance.

4.1. Course evaluation

The E-commerce course was the last in a series of three courses developed in the project. The design pattern of the first developed course was repeated in the two following courses. The design of the first course was reviewed in the following ways:

- pre- and after-action reviews by students,
- interviews of teams of students,
- interviews of teachers and study coordinators,
- interviews of external experts and customers,
- analysis of learning results.

Students, teachers, study coordinators and external experts and customers rate the course as meaningful and a successful realisation of real-life multi-disciplinary education, relevant in professional practice.

Teachers liked the focus on professional practice and the 'freedom', i.e. the responsibilities, given to the students. On the other hand they found it sometimes difficult to give appropriate support and feedback to the students. The teachers introduced weekly meetings between themselves which helped considerably to cope with encountered problems. The time allotted for student support was deemed short, given that this way of teaching was new to most teachers. ICT-support by Lotus LearningSpace was only used for formal communication; informal communication was done via the email-facility the teachers normally used. Study load and project planning were deemed satisfactory.

Students were particularly positive about working in a team with students from other disciplines and about the opportunity to inspect and analyse other business environments. The study load was perceived as heavy, compared to other courses. The level of the course was deemed appropriate. Students found it difficult to be dependent on one of their fellow-students (and her or his company) for business information. Student materials were satisfactory, but ICT support (Lotus LearningSpace was used) was unsatisfactory. Dissatisfaction with ICT-support was mostly due to organisational problems (response time

was too long), not technical problems. But students also found the use of yet another ICT-application for communication a bother and preferred their own e-mail application, integrated in their ICT working environment. The additional groupware functionality of LearningSpace provided not enough of a counterbalance. However, the function where products could be submitted electronically was highly valued.

External experts, and customers were very enthusiastic about the work and study commitment of the student teams. However, they pointed out that the quality of results tended to vary considerably. They were positive about the use of an ICT-environment like LearningSpace.

Additional student reviews of the E-commerce course brought the following points forward:

- The course gave students the opportunity to apply and evaluate knowledge and skills developed in other courses; this was seen as a very rewarding aspect of the course.
- In the business plan students had to develop an operational vision for a real business in stead of just a standard vision derived from literature; this aspect was valued by the students as very meaningful.
- The multi-disciplinary teamwork was found rewarding by the students. In particular the fact that students from different disciplinary backgrounds could make sensible contributions to the overall result.

The pilot run of the E-business course was done in the academic year 2001/2002. The results of the first 'normal' run of the course in the academic year 2002/2003 were as follows. In the course participated 17 student teams. Of the 83 students taking part in the course 78 students passed the course with grading level 'satisfactory'.

4.2. Organisation of (learning) activities

The organisation of (learning) activities is an important aspect of task-based team learning. In the design a model was followed that is often used in professional practice:

(1) *Problem analysis*: Analyse the task set and specify desired result of task performance;
(2) *Plan* the activities that should lead to the desired result, following a professional *Method*;
(3) Put the plan into motion and produce the desired *Result* following the *Method*;
(4) Explicitly exercise quality control by *Reviewing* and *Assessing* activities performed and results realised with the help of coach(es), external expert(s) and customer.

A detailed description of this model can be found in (van Weert, 2002b).

Reviewing and assessing presupposes that criteria have been developed against which can be reviewed and assessed. Example criteria for the case of the E-business course can be found in Section 3.4 for problem related activities and results, and in Section 3.5 for learning results.

The application of this model in the design of task-based team learning courses was found to be effective. However in practice too much attention was given to reviewing quality of the result, which left reviewing of quality of activities lacking.

4.3. Organisation of team learning

Team-based learning is closely connected with the constructivist approach of learning. In the courses students worked together on a complex professional task in various roles. These roles were related to the content of the task. A choice of which role to play depended on the capabilities of the student and on what competences the student wanted to develop. It is well-known that co-operation of students in groups will not necessarily be effective. To discuss the measures taken in the design and the results gained we use the categories of group work that Johnson and Johnson (1994a) use to differentiate levels of effectiveness (cf. Figure 1):

- *Pseudo group*
  There is no incentive for co-operation, group members do not help each other, but work in groups does create disturbances and misunderstandings; the group result is less than the sum of the potential results of the group members.
- *Traditional group*
  Group members are in principle willing to co-operate, but do not see much gain in this co-operation; the work is structured in such a way that most things can be done individually; members only feel responsible for their own part of the group work, but will share information on how tasks can be undertaken; the group result is more or less the sum of the potential results of the group members.
- *Co-operative group (team)*
  Group members work to attain a common goal and to maximise own and collective results of high quality; social competences are developed and applied, effectiveness of

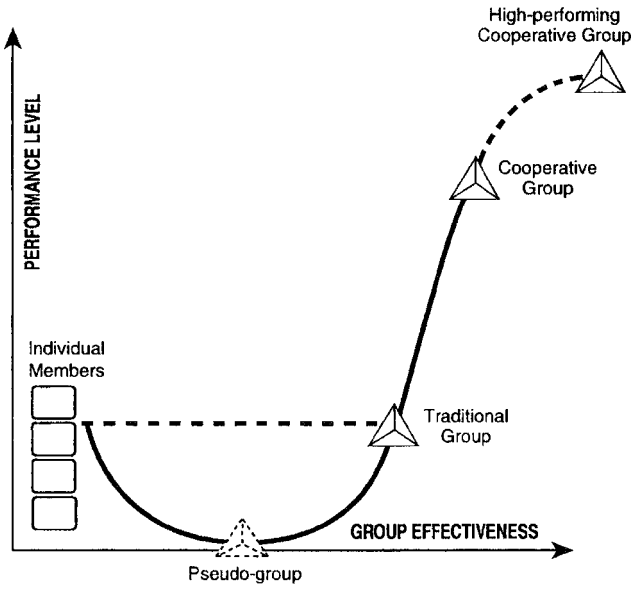

Figure 1. Group performance curve (Johnson and Johnson, 1994a).

group and group members is analysed and remedial actions are undertaken; the group result is more than the sum of the potential results of the group members.

- *High performance group*
  This is a co-operative group in which members have great commitment to both their own personal development and that of others, and also have great fun working in the group.

Effectiveness of co-operation in groups can typically be enhanced by the following didactical measures (Johnson and Johnson, 1994a; van Weert, 2001a):

(1) Arrange for high quality, face-to-face interactions, giving added value.
In the courses developed this was realised through progress meetings which proved to be effective.

(2) Arrange for positive dependency of group members on each other, so that they can experience the positive effects of peer explanation and peer support; arrange for decisions to be taken by the group (not by the teacher coach) on the basis of consensus.
In the course design care was taken that the problem had to be approached in a multidisciplinary way and that the method left room for student decisions. This was taken up well by the student (part-time students with work experience).

(3) Arrange for individual responsibility within a group context; each member of the group should be responsible for own performance and for the performance of the group as a whole.
In the course design this aspect was realised by the assessment mechanism that had an individual component (on the basis of a Personal Development Plan) and a team component (on the basis of the team result).

(4) Let students develop competences for co-operation through meaningful group tasks, positive feedback and decision making on the basis of consensus.
Here it was important that teachers supporting the students helped students to identify meaningful tasks, provided positive feedback, but did not make decisions for the students.

(5) Let students monitor and review their own work and that of the group; without monitoring and reviewing the group cannot be sure that it is performing well.
In the courses student progress meetings were used to review and monitor work. However, quality control was lopsidedly focussed on results.

4.4. Organisation of ICT

ICT-facilities were organised for students and staff and were accessible both from within the institution and from the outside. Both students and staff were introduced to the functionality of the facilities in such a way that these could be used without problem. Support of the facilities was arranged and organizational matters of the ICT-environment was looked after. Formal aspects of the use of ICT were dealt with and fall-back options in place.

However, motivation for use of the prepared ICT-environment was lacking. The functionality provided was not convincing enough to replace existing ways of working, with or without ICT.

4.5. Conclusion

In the domain of Economics and Management three courses have been developed and implemented as task-based team learning with ICT. The implementation was found to be satisfactory by students, teachers, study coordinators and external parties. Design, development and implementation of the courses provided valuable learning experiences which have been assembled, together with good practice from literature, in two guidelines, one for design and one for development and implementation. To bring these learning experiences in relation with one another a process model for design, development and implementation was introduced. This is presented in chapter 5.

5. Implementation Process and Success Factors

Learning experiences from design, development and implementation of task-based team learning have been assembled, together with good practice from literature, in two guidelines, one for design and one for development and implementation. The developed guidelines were reviewed with respect to (critical) success factors contributing to success or failure of these processes. Some of these success factors were deemed to be critical, others non-critical. Identified success factors have been validated by experienced designers and developers/implementors.

5.1. Complex innovation

In the project under consideration the explicit aim was to realise educational innovations at programme level. Therefore there were implications for not just one, but for a combination of courses or modules. The innovation had consequences which cut through the borders of courses, disciplines and sometimes departments. The combination of changing the orientation of education and changing the technical infrastructure, the size of the innovation and the changes needed in the educational organisation made the innovation complex. Higher education has little experience with such complex innovations. There is also limited experience in the field of ICT research and evaluation of curriculum innovations. Therefore an analytic part was included in the project to learn from earlier experiences and to identify and apply good practice. The implementation situation in the participating institutions was quite different with respect to the type of tasks and the formation of student teams. This diversity made it possible to review the application of good practice. As a separate issue the University Medical Centre Utrecht also researched the use of the so-called ‘Aquabrowser’ in learning. The ‘Aquabrowser’ is an ICT-based search engine allowing search by association. Search results are also presented in an associative way. The working of the Aquabrowser can be inspected at: *http://uu.medialab.nl*.

5.2. Process model

Substantial implementations of new learning imply changes in the organisation of education, the roles of students and teaching staff, and the infastructure. These changes are often more profound and farther reaching than at first perceived (Kjersdam and Enemark, 1994). Design and development process therefore have to take these implementation changes into account. Because of this, the design and development process become complex activities and have to be split into sub-processes for effectiveness. In this project we therefore have separated *Design Process* and *Development Process*, keeping in mind that implementation is the ultimate goal. In the design phase the boundary conditions for the implementation are identified in the *Development Briefing*. In the development phase a concrete educational implementation (task-based team learning with ICT) and supporting educational materials were developed within these boundary conditions.

In our project we have identified *Didactical Model*s, taking account of (changing) student and teacher roles, which were used as the basis for design and development. We also took account of changes in the educational organisation by introducing *Management of Change*. As our courses aimed to integrate use of ICT, also the *Information and Communication Technology-Basis* (both the technological and human resource basis) was taken into account. Finally we have found it useful to identify the *Starting Position* of the educational institution or educational programme as the starting basis.

5.3. Success factors

In the analytic part of the project good practice was identified from literature and assembled in two sets of guidelines, one set of guidelines for the design of task-based team learning with ICT (van Weert, 2001b) and one set of guidelines for the development (Ritzen, 2001). The Design guidelines deal with the elements Starting Position, Management of Change, Didactical Model, Design Activities, Design Result (Development Brief) and Information and Communication Technology Basis from the process model presented in Figure 2. The Development Guidelines concentrate on the Development Process and the concrete implementation of task-based team learning with ICT of the process model.

These two guidelines were then reviewed with respect to the (critical) success factors contributing to success or failure of the courses developed. There are always risks in course design and development, and specifically so in this type of education (task-based team learning), because students have an explicit responsibility for their own activities. Therefore the course of events cannot always be predicted in detail. What are then the (essential) factors deciding on success or failure of design, development and the running of such courses? The design and development guidelines were reviewed to identify success factors and the actors involved. In the last stage of the project these success factors were validated with the identified actors.

Success factors are presented as actor actions which should lead to a specific outcome. The success of a factor is measured by the extent to which the realised outcome fulfils associated criteria. The criteria are formulated as conditions which have to be fulfilled.

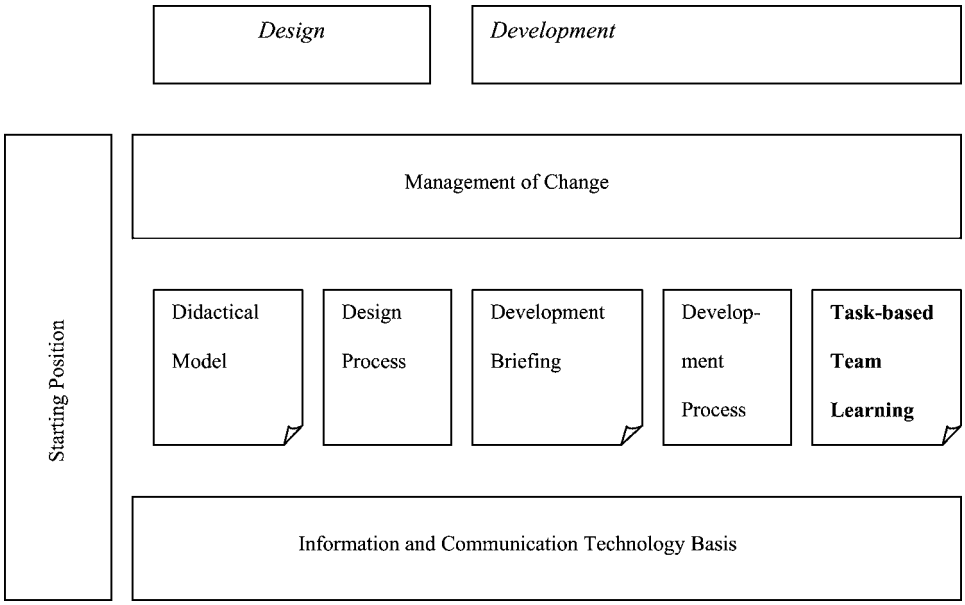

Figure 2. Process model.

Probability of success is higher in cases where actors are able to exploit a complex of success factors to realise a better outcome. When success factors are not exploited, the probability of problems, or even failure, in the outcome increases. Some success factors may be critical: if success in the outcome is not achieved, efforts are doomed to failure. If a success factor is not deployed properly, it turns into a risk factor. Success is still possible, but in the end success is dependent on random circumstances.

5.4. Design phase success factors

The actors involved in the design phase are the Programme Management and the Design Team (for example: Curriculum Design Committee). They can influence the quality of the Design Result by taking account of success factors connected with the design phase elements in the process model of Figure 2. As an example we summarise the success factors connected with the Starting Position of the institution or programme in Table 3. These factors predict the success of application of the Management of Change, the Didactical Model and the ICT-basis needed for the innovation. In our experience successful development of task-based team learning at programme level is only possible if the Starting Position of the institution or programme is at least at the level of *Applying ICT*.

In our experience the success factors connected with Management of Change, Didactical Model and ICT-basis are also critical. Among the success factors connected with the ICT-basis are: ICT-facilities for staff and students; continuity in facilities; ICT-competence of staff and students; trouble shooting, support and maintenance of ICT-facilities are organised; there is room for new investments; fall-back options (what happens if the technology

Table 3. Starting positions of institution or programme

The envisaged innovations have to fit the starting position of the institution or the study programme. This is seen as a *critical* success factor, because failure is fairly certain if the innovation is 'a bridge too far'.
Four typical Starting Positions were used in our project. These have been identified by the International Federation for Information Processing (IFIP) (van Weert, 2000).

Starting with ICT
This position is that of an institution or programme in the beginning stages of ICT development and educational innovation. The department begins to purchase some equipment and software. In this initial phase, administrators and teachers are just starting to explore the possibilities and consequences of adding ICT for management and the curriculum (change management is not yet needed). The educational programme is still firmly grounded in traditional, teacher-centred practice (the didactical model is traditional). In this approach ICT is used at the level of basic skills and awareness of the use of ICT (the ICT-basis is in an early stage).

Applying ICT
This position is linked with an institution or programme in which new understanding of the contribution of ICT to learning has developed, but teachers still largely dominate the learning environment (changing didactical model). In this position administrators and teachers use ICT for tasks that are carried out in departmental management and in the curriculum (some experience with change management). The use of ICT in various subject areas with specific tools and software is increased (an ICT-basis is emerging).

Integrating ICT
This position is linked with an institution or programme that now has a range of technologies both in laboratories, classrooms and administrative offices (experience with change management). The departmental staff explores new ways in which ICT changes their personal productivity and professional practice (broadening of ICT-basis). The curriculum begins to merge subject areas to reflect real-world applications (innovation in didactical model).

Transforming with ICT
This position is linked with an institution which has used ICT to creatively rethink and renew institutional organisation. ICT becomes an integral though invisible part of daily personal productivity and professional practice (change management is normal practice). The focus of the curriculum is now learner-centred and integrates subject areas in real-world applications (the didactical model is fully learner centred). ICT is a subject at the professional level and incorporated into all vocational areas (the ICT-basis is well developed). The institution has become a 'learning community' and serves various target groups.

More details can be found in (van Weert, 2000, Appendix A).

breaks down) are available; formal aspects of ICT-use in education are taken care of. Finally sharing of knowledge, building up of motivation for ICT-use and creating a library of good practices need to be organised.

Among the success factors connected with management of change are: staff should learn how to design and evaluate experiences; success has to be organised and will not materialise of its own; sustain success actively; invest in success and start by investing in the quality of the work of the programme management and design team.

The full set of success factors for the design phase can be found in the design guidelines developed in our project (van Weert, 2001b).

5.5. Development phase success factors

The actors involved in the development phase are the Programme Management and the Development Team (for example: a team of teaching staff supported by consultants). They

Table 4. Success factors in the development phase

(a) Quality of the Development Brief (*critical* success factor)
(b) Operational familiarity of the Development Team with the characteristics of *task-based team learning with ICT*
(c) Expert support for the Development Team
(d) Boundary conditions development activities have been specified
(e) Quality of Development Action Plan
(f) Focus on student activities, including criteria for process and result
(g) Level of student responsibility in the project
(h) Integration of competence development in project activities
(i) Integrated use of ICT
(j) Student coaching and assessment
(k) Quality of the resources
(l) Quality of the Student Materials
(m) Content of digital learning environment
(n) Reviewing of all preceding success factors ((a) to (m))
(o) Pilot run and evaluation
(p) Training student coaches
(q) Communication: What, with whom and when?
(r) Implementation into the regular educational process
(s) Knowledge sharing

can influence the quality of the resulting implementation of task-based team learning with ICT by taking account of success factors connected with the development phase elements in the process model of Figure 2.

The development phase needs a Design Result (Development Brief) to start with. If no Design Result is available there is a great risk that this complex educational innovation will not be successful. We therefore see availability of a well-developed Design Result as a *critical* success factor. Success factors that have been identified in our project for the development phase are summarised in Table 4. Full details on these success factors and the criteria which decide the success (or failure) of these factors can be found in the development guidelines (Ritzen, 2001).

5.6. Discussion

In this paper we have presented just one example of task-based team learning with ICT, a course on E-business. Because of the different settings of the educational innovations (Faculty of Economy and Management, Hogeschool van Utrecht and University Medical Centre Utrecht, University of Utrecht) we have seen a far broader spectrum of educational innovations in the project, and also a broad spectrum of implementations.

Theoretical observations of learning processes, team learning and ICT-use in learning situations have been collected from literature. In literature many success or risk factors are described. These have been adapted on the basis of experiences in the design, development, implementation and evaluation of the actually realised innovations. We have found added value in putting these success factors in operational form with clear relation to a process model for design, development and implementation that was used in the project. The

operational form and the relation to the process model used in our project helped us to make success factors more coherent and consistent, and made validation easier.

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