IT Support of Competence Based Learning in Groups in a Distance Learning Environment

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Abstract: In this paper the design of a workflow support tool for competence based distance learning in a group setting is discussed. The design is based on a stakeholder analysis and crash-tested in an actual course setting. Preliminary findings suggest that some well-known problems have been solved, but further more in depth research is needed to assess the quality of the design with respect to more subtle issues.

Keywords: Competence based learning, group setting, workflow support, group management.

1. Introduction

Recently, the Open University in the Netherlands (=OU) has endorsed competence based learning as the future didactical framework for course development and exploitation. The Open University is an institute, which provides distance-learning courses. Typically, the students have already some working experience and are eager to develop their careers. Students are increasingly critical with respect to the quality of the education they get from the OU. In addition, government funding is under constant pressure, which limits the resources available for course development and exploitation. For training students in business process engineering, the OU uses competence based distance learning in a group setting (GCBDL Courses). Typically, business process engineers operate in multi-disciplinary groups, and the success of a business-reengineering project very much depends on collaboration and communication skills of the group participants. In addition, collaborative learning stimulates the communal sense with students (Seufert, 2002). Research by Kear and Heap (Kear&Heap, 1999) suggests that although students complain about the additional overhead and limited freedom of collaborative learning, the majority of the students believe universities should continue in providing collaborative learning courses. Thus, academic discussion and interchange of ideas is stimulated providing a noticeable added value to the participants. The Internet as a medium for communication within distance learning has opened new possibilities of distance learning in general.

Competence based learning has received much attention from a didactical perspective, in which predominantly the effectiveness of the learning processes of the students is addressed. In addition, much attention has been paid to the development of electronic learning environments, in which the presentation of course content and rather crude communication facilities was paramount (e.g. see Martin, 2003). Unfortunately, almost no attention has been paid to the consequences of competence based learning on a large scale and on a routine basis. Some courses at the Faculty of Management Science at the OU already follow the pattern of competence based learning, and first informal experiences indicate that, in particular during the exploitation stage, amongst other issues, the administrative workload for students and supervisors can be prohibitive and that supervisors and students sometimes lack control to finish their assignments on time.

In this paper, we will focus on the implementation aspects of this type of GCBDL courses on a routine basis. We will analyse systematically the workflow requirements, which are associated with this type of course from an industrial engineering perspective. This analysis will serve as a basis for improvement of the workflow. In particular, we will concentrate on the potential for improvement of GCBDL-supporting information systems. We will use the business-reengineering course as a test case. This course is offered to about 100 students per year, who start in batches of about 15 to 20 students from several different master

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programs at various moments throughout the year. In addition, some course material is used in a similar setting for company training purposes. External supervisors are contracted as needed.

2. Problem definition

The competence based learning strategy leads to courses where students are put in a realistic situation in which they have to demonstrate if and how they solve certain problems. Absorption of cognitive knowledge is considered insufficient. The key objective is to be able to use knowledge to solve realistic problems. In practice, this learning strategy can be translated into course patterns, which make use of case descriptions and assignments for groups of students. On an academic level, the assignments typically require the students to make an analysis and construct a systematic and clear argument for a solution. Compared to traditional cognitive based learning approaches, such assignments will require manual feedback from scarcely available professional supervisors. In addition, supervisors have to keep track of the students' states and the responses as the "body of evidence" for the students' assessment. Although no formal in-depth studies have been discovered in which traditional courses are compared with similar scoped GCBDL-courses, experienced supervisors estimate the extra effort roughly to about 2 to 3 times compared to a traditional course design. Veen et al (Veen,. 1999) reports similar findings on a workload increase with GCBDL-courses.

In general, regular course evaluations suggest that many students perceive that GCBDL-courses increase the workload. It is no longer sufficient to prepare for a single examination, but instead, the students have to produce a full final report, which they all have to agree upon, and possibly several written responses to intermediate assignments. All these symptoms, may be acceptable if competence based learning is used incidentally. However, if used on a routine basis some further research seems justifiable.

> *Our basic research question boils down to: "How can we implement GCBDL courses efficiently?".*

2.1 Methodology

The symptoms identified in the previous section indicate that we need to analyse the workflow of GCBDL courses to understand its management and administration problems better in order to be able to facilitate a GCBDL-workflow. We will follow the design cycle as the primary guideline in our approach. The design cycle entails the following stages:

- *Determine design objectives;* In this first stage we need to determine what criteria are relevant and must be met for an acceptable workflow. Besides the course design criteria we need to determine what stakeholders exist and what their requirements actually are.
- *Considerations for design;* In this stage, the requirements from the previous stage have to be interpreted and related to the main options for facilitating the workflow. Finally, the most suitable options will be chosen for the development of a prototype instrument.
- *Develop a prototype;* A full prototype version of the workflow support instrument will be developed and discussed
- *Evaluate prototype;* Eventually, a prototype needs testing. In this stage a working version of the workflow instrument will be put to the test with a real life course
- *Re-iterate if necessary;* In case the evaluation reveals shortcomings in the prototype, the design cycle can be re-initiated at each previous design stage

2.2 The design of a workflow

2.2.1 Stakeholder analysis

For a successful design of a workflow support system it is essential to have a clear picture of the relevant stakeholders, or actors in this case and what their interests in such a workflow support system would be. In the following sections we will discuss the stakeholders and their interests in depth. The insights presented here originate from regular evaluations that are carried out after each course run of the Business process engineering course and regular evaluation meetings with supervisors and examiners of this course.

Developer

The didactical model, used or designed by the developer, is leading for all other roles. The developer is more or less a generic role, he may comprise a team with mixed specialisations in the content area, pedagogy, programming, legislation, finance, etc.. Course development may require some attention to project management. In particular, if the course material is novel and not much existing content can be reused. Besides, achievement of the quality standards for educational content demanded by the institution offering the course and the accreditation boards, other secondary requirements must be met by the developer. Depending on the situation at hand, a wide variety of restrictions must be taken into consideration. Implementation of a course in a routine workflow is considered an administrative duty, for which any effort should be minimised.

Examiner

The examiner, being responsible for the examination of students, is an officially appointed expert on the course material at hand. He assesses the performance from the student using the standards the developer of the course has set. The outcome of such an assessment is usually summarised in a number from a preset range. The standards may encompass many heterogeneous aspects such as the level of knowledge that has been accumulated, the throughput time to complete the course, the amount of supervision that was needed to guide a student towards the completion of a course, etc. Much of the feedback of intermediate course assignments can be delegated to a so-called supervisor role. In that case the examiner requires that supervisors adhere to his standards for providing feedback in terms of timing, content and student progress in general. The examiner rating has a legal status, i.e. disputes between students and examiners may be taken to court if conventional arbitration fails. This emphasises the administrative precision and formalism the examiner has to practice.

The examiner must collect all evidence in support of his assessment and he must assure that the course has been followed in conformance with the prescribed didactical model.

Student

The student is the main beneficiary of a course. He executes the assignments and tests prescribed by the examination standards in accordance with the didactical model. The student's main motivation comprises two elements.

- a gain in competences on the particular area the course within the program he selected and;
- the certificate he receives upon successful completion, which in turn, depends on a positive rating by the examiner.

Ratings and comments from a supervisor or the examiner must be clearly linked to student responses to the required assignments.

Secondary, but nevertheless, important motivational aspects are the facilities that are provided in order to help him to complete a course successfully. Typically, in GCDBL-courses additional effort is needed to manage the group process. If a GCDBL-course is large and involves a substantial number of assignments over an extended period of time, project management type of control of the group progress may be welcomed.

Manager

The manager is responsible for the overall economic efficiency and the market validity of the courses offered to the students, a.k.a. the clients of the educational institution. The manager makes the decisions to introduce a course or a program to a certain market and what features are needed for a successful exploitation, the development cost that can be justified and the management that is required for the development, promotion, maintenance and exploitation of a course. Given the wide range of responsibilities, this role is seldom attributed to a single person within an organisation. In the end, the dean is formally responsible for all aspects mentioned here, but ideally, all individuals involved in the processes mentioned above will carry this responsibility more or less implicitly.

The manager role is interested in the overall efficiency of course runs per course. The effort spent by the supervisors, examiners, and students is monitored and should not exceed a preset budget. Additional quality requirements such as the percentage of students who completed a course successfully and qualitative student evaluations complement the manager's information requirements. The manager has no direct involvement with an individual course run. Due to budget pressure this role has gained in importance significantly and will have a much larger impact on a work flow system than a few years ago.

Supervisor

The supervisor acts as an intermediate between the student and the examiner. The supervisor assists the examiner in collecting "evidence" of the student's performance during a course run. In addition, he is the first member of staff a student contacts in case he requires assistance, advice and feedback on his work. The supervisor is also responsible for the progress students are making. To do this, the supervisor needs to know the actual planning of the students at any time. Depending on the course requirements and the sophistication of the course material, a supervisor may not need to have full expertise on the content subjects of the course at hand. In such cases, a supervisor's responsibility is to stimulate the student's pace and to provide only basic safeguards from a content perspective. In other words, the supervisor resembles more a principal than an instructor.

Administrator

The administrator is responsible for the official admission of students to participate in a course. He may check the student's admission qualifications before commencing with the actual enrolment of students. At the end of a course, an administrator may want to update the official student dossiers with the examiners rating and file any other required documents.

Veen et al. (Veen, 2001, and also Veen,Collis,Diepen&Andernach, 1997) have studied the management challenges introduced with collaborative learning extensively. His analysis can be summarised as twelve major problems of group workflow problems:

Problem *planning, operationalisation & monitoring*

Table 1: (Source: Veen, 2001, p.45)

1	Groups do not have a clear picture of what is expected of them. *planning*
2	Groups have problems with planning and procrastination. *planning*
3	Groups have problems with organizing work between meetings. *operationalisation & monitoring*
4	Groups have problems with access to deliverables and comments. *operationalisation*
5	Group members do not take a fair share of the work. *operationalisation & monitoring*
6	Instructors lack overview of the progress of groups. *monitoring*
7	Different instructors treat groups in different ways. *operationalisation & monitoring*
8	Instructors have difficulties to continue their work at a distance. *operationalisation*
9	Students have limited awareness of other group members. *operationalisation & monitoring*
10	Conflicts arise due to poor communication. *operationalisation*
11	Students do not start using telematic support tools. *operationalisation*
12	Groups have to wait too long for instructor and peer comments *operationalisation & monitoring*

A workflow support system should address the problems identified above.

2.2.2 Design considerations

To address the requirements of stakeholders a number of facilities should be provided by a workflow support system. In the following section the most important design directions will be discussed.

Providing a structured path

Examining the way groups worked in an earlier version of the Business-reengineering course, which was not supported with workflow support tools, we have recognized a pattern described by McConnell (2002).

a) A long first phase characterized by considerable negotiation between the members of the group working closely together. Several sub-phases are evident in the groups' work.

b) A medium-length second phase characterized by the group organizing itself and busying themselves with particular parts of the research around the particular problem.

c) A short third and final phase, characterized by production.

Before students are asked to work in groups they will meet at least once at the beginning of a course run. We assume that no real substitute exists for getting acquainted quickly. No tool is provided for this stage of a group project. Also, at this stage it should be agreed upon who is responsible for what aspects in the workflow. In particular, the problems 9 and 1 in Veen's list are addressed.

All assignment responses and comments should be archived, logged and made visible to the individual group members, supervisor and examiner, including all revisions of student responses and supervisor comments.

The supervisor role should have final control on when an intermediate assignment has been answered satisfactory and a group can move on to the next assignment (problems 4 and 6).

Monitoring deadlines

It is a group responsibility to set and monitor delivery dates for sending responses to (intermediate) assignments. Equally, supervisors have to answer within a preset time frame Setting these time standards would allow an automatic alarm system sending appropriate warnings to all participants, who have trouble in meeting the deadlines. In addition, all assignment related communication events should be logged. Thus, all essential data is available in a formal and relatively indisputable way, which should minimise defensive behaviour of all roles involved (problem 6 and 12).

Maximum accessibility

Any support tool can be easily bypassed if users disagree with the way in which the tools more or less enforce a certain standard workflow. If this happens, the workflow itself is in jeopardy. In general, we assume that examiners and supervisors are bound to use the support tool and must be intolerant to any deviation. On the other hand, students may have very good reasons to reject the facilities provided to them. The tool may be too complex and requires a steep learning curve, or the technical requirements of the tool exceed the available PC specifications, to name just two of the more frequent reasons for rejection (problems 11 and 4).

A possible solution to this problem may be to provide the tool as a web-application which can be accessed by most browsers on any internet enabled PC anywhere in the world at all times. Secondly, the design objective could be to minimise the functions to those that are absolutely necessary and avoid a "Jack of all trades" approach ("Simplicity versus functionality", see Veen,Collis&Jones 2001). The philosophy is that, the fewer functions are provided, the fewer reasons are available to bypass the tool. We expect that other tools available in the market, which the students can choose to their liking, can easily add missing non-critical functionality. In this setting, self-controlled selection of facilities provides the students with a certain degree of freedom to choose their own instruments and should actually encourage students to take initiatives and go ahead.

Simplicity as a design paradigm is also applied in the level of sophistication a workflow support system should have. We were looking for simple and robust solutions. E.g., instead of trying to design an advanced automated agent system that could act as the primary supervisor (see Palazzo et all, 1998), we concentrated on just making all relevant data easily accessible to a supervisor.

2.2.3 The basic workflow implementation

A workflow support tool, named the "Back Office" was developed to implement the requirements listed in the previous section. The Back Office was developed with Delphi 7 Enterprise Edition[i], Intraweb version 5[ii] and Firebird DBMS version 1.03[iii]. We have separated the workflow in roles. Each role has its own responsibilities and tasks in the overall workflow. For each role a separate web-application has been developed and installed on standard PC with permanent Internet connection.

Table 2: Key functions of the back office application

Type of application	Role	Key functions
W	Examiner annex Course developer	Define/maintain course structure, assignments (group and individual) Define/maintain FAQ for supervisors to aid them in providing feedback to student work Compose/change student groups. Monitor individual and group process Ability to email all or selection of all current participants Manage course runs (timing) and authorise supervisors and enrollers Rate students Provide digital course material (for download only by students) Export course run data to XML-file for offline analysis
W	Enroller annex Administrator	Enlist students Authorise/(un)block/withdraw student participation Welcoming of new students via automated email. Monitor final rating from examiner Authorise examiner for closing down a course run.
W	Supervisor	Monitor progress of individuals and groups provide and distribute feedback to students/groups (times and contents are logged) Facilitation of automated email to individuals and groups Rating of assignments Decide whether individuals/groups are allowed to proceed to the next assignment or to improve their current work.
W	Student	Define/maintain individual and group planning (via setting deadlines for each assignment) Download course material and standard comments provided by examiner Read and respond to supervisor feedback Maintain a shared group file repository Ability to send automated emails to supervisor or group members.
W	Due date monitor	Send automated emails to all roles who have exceeded certain deadlines: Students approaching/hitting/exceeding deadlines (warning) Supervisors approaching/hitting/exceeding feedback deadlines (warning) Minimum planning resolution defaults to one day, but can be changed.
W= web based, A= automatic, runs once per night. Email is sent by the web server, instead by a local email client and is referred to as “automated email”.		

In parallel a monitor program runs daily to check if additional warning messages should be send and to perform automatic backups of the database. This monitor program introduces a “push element” into the back office, whereas traditional web applications are “pull-driven”. An action of a student or a supervisor always calls for another action. It is hoped that, in doing so, the likelihood that the group progress stalls is lessened significantly (see also Hauswirth 1999). The separate applications and their key functions are summarised in table 2.

Implementing the back office workflow.

To enable testing the workflow, a web-application and central database have been developed. All web pages resemble normal windows data entry forms. However, these forms are generated on a central server and displayed within a browser on a local PC. All persistent data has been modelled into a database management system accessed by the web-application. This implementation provides instant database update capabilities and access from users on any PC connected to the Internet. Access to a web-application is achieved with a login-procedure in order to protect the users' privacy.

In addition to the support of the basic workflow several smaller enhancements were implemented to encourage users to use the back office. E.g. student groups have a shared file repository they can use privately. Scheduled assignments are presented graphically (see figure 1). Special attention has been paid to the help system for the student web application. Help is available in full text and so called Flash movies.

One of the design considerations was transparency of data. In the implementation, this aspect has been translated into extended logging of all relevant actions by any user and full visibility of the data that is related to a logged action. E.g. date and time are recorded of any assignment related response from a student, which can be a typed response in the browser itself or via an upload of files. In turn, all supervisor comments are logged as well. In addition, all uploaded files, comments, etc. are visible and downloadable (see figure 2 for an example). According to Armatas (Armatas c.s., 2003) distance students value having full access to their own data and being in control of their schedule much more than on campus students do.

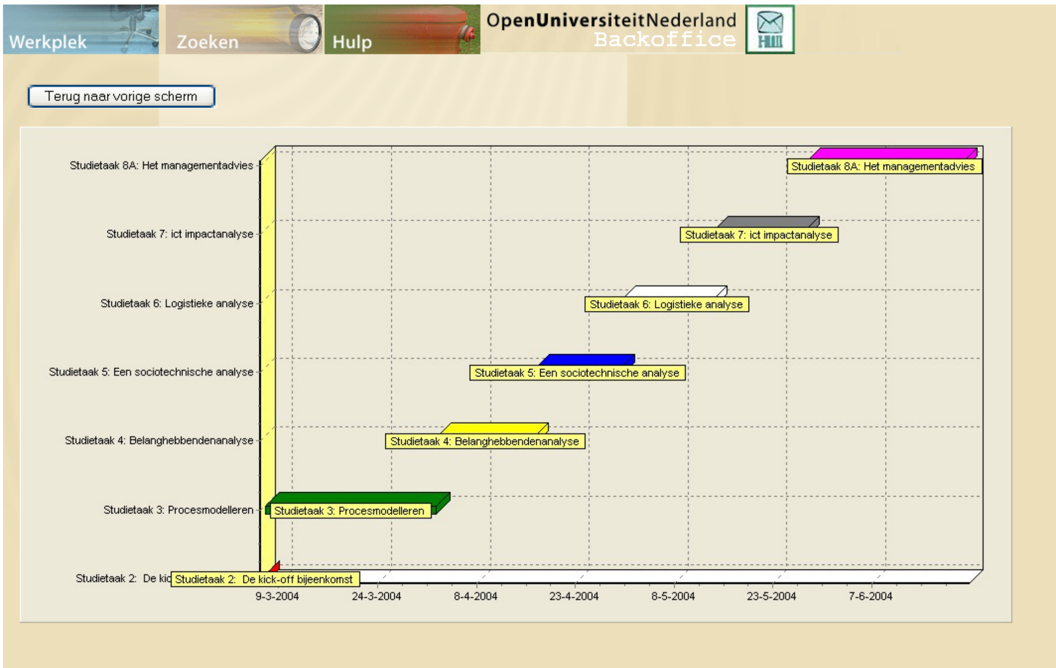

Figure 1: A graphical presentation of a student schedule.

Figure 2: An example of a table showing all student assignment responses and comments from the supervisor.

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3. Conclusion and future challenges

At the time of this writing the prototype workflow support tool (the Back Office) has been tested for stability with a number of groups of business reengineering students. So far, 5 groups with in all 20 students and two supervisors have used the Back Office on a regular basis for a period of about half a year. Students and supervisors were asked to report any dissatisfaction immediately to the research team.

So far, no in depth evaluation of this prototype and the considerations behind this software has been carried out yet. Therefore, no solid conclusions can be drawn at this time. However, no major complaints have been received from the students and the supervisors. Minor issues such as long upload times could usually be attributed to large bitmap files students have included with their responses. Once the students were made aware of this, further problems could be avoided. Remarkably few requests for support from students or supervisors were made. This may be an indication that the minimalist approach does work as desired. No students have rejected the tool.

The Back Office has solved some of the twelve problems identified by Veen (Veen, J. van der, 2001) right away. Groups have direct access to deliverables and comments (problem 4). This may not be a attributed to just appropriate tool design, but also to the quality of internet connections students have nowadays. However, a potential threat for any Internet based support tool is the Firewall policy of Internet providers. Although no real problems emerged during the first debugging tests, one can expect that different Firewall policies may seriously impair legitimate Internet communications.

Different instructors can now treat groups much in the same way and use the same criteria to support their feedback to the groups (problem 7). Further studies may be needed to discover if standard feedback, or FAQ lists, is the best solution indeed. Groups don’t have to wait too long for comments (problem 12). Automatic monitoring provides warning signals to those who are late with their task.

The problem of students not using telematic support tools (problem 11) and poor communication (problem 10) may not be as dramatic nowadays due technological advancements in communication technology and the widespread acceptance of these technologies by the students. At this stage, no complaints from students have been received, indicating that standard communication means were insufficient, or that the quality of student responses was hampered due to insufficient communication.

The remaining problems may be addressed partially by the Back Office and partially by the way in which a workflow is organised. The contribution of the Back Office in these problem areas does require further investigation. E.g. to assess whether group members do not take a fair share of work (problem 5) would require more insight on how groups actually allocate the tasks at hand. Unlike in classroom teaching, in which a supervisor is a direct witness of actual group processes, in distance learning a group process is largely hidden from the supervisors view. To ensure a sound group participation, different strategies can be followed. Daradoumis et all (Daradoumis, 2002) log all student events in their system, forcing students to route all of their communication to the official channel to achieve recognition (formative tracking). Such a system would require almost 100% uptime and total ease of use for the users to make this a serious option. A totally different approach is suggested by Seufert (Seufert 2002). He argues that if the learning environment and the working environment is connected, students will be more motivated as learning success can be transferred into their work and vice versa. However, this may be difficult to realise in practice. Vick & Johnson (Vick&Johnson 2005) solve this problem by providing specific software, which supports brainstorm and problem solving software for geographically dispersed group members. The software requires that all group members contribute evenly and synchronously. In a sense, a live guided discussion between group members is facilitated and logged for future references. So far, the problem has not been tackled with the aid of some back office functionality, but through course

design. Currently, for the Business reengineering course a strict pattern of responsibilities is agreed upon during a kick-off meeting at the beginning of the course, but this pattern is not strictly enforced. In addition, each individual student is required to send a personal reflection report on the group process and his personal perspective of his contribution.
The discussion presented above makes clear that the “Free-riders” problem is complex and needs further investigation.

Currently, the workflow doesn’t support groups or individuals within groups to interact with each other as a community. Lou (Lou, 2004) suggests that communities provide an even richer learning environment to students with unique opportunities to implement peer assessments. Further, long term research in this area is needed to explore the possibility to enhance our Back Office design with community building.

Implementations of group management software at the Fernuniversität Hagen (Haake et all, 2002) suggest that in the area of enrolment and group forming improvements can be made. In their implementation, individual students select the groups they want to collaborate with themselves. Initially, an individual in a student pool solicits for a group membership of a group of his preference. The existing group members have to accept, or reject the new applicant before moving on. This setting demonstrates three interesting benefits. Since students group themselves, essentially no significant support from the university staff is needed, saving valuable resources. In addition, all responsibility for the success of a group now rests solely with the individual group members. The university staff cannot be blamed for a failed group process. Also, batching students in groups at regular intervals introduces peaks in the workload of examiners and supervisors. In the pooling system, there is no need to batch group formation. As soon as there are enough students available, students can start grouping. Further assessment of the “Hagen” system is needed to discover if this method can be applied in a back office system at the OU as well.

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[i] Delphi 7 is a registered trademark of the Borland Software Corporation.

[ii] Intraweb is a registered trademark of AtoZed software.

[iii] Firebird is a DBMS system distributed under Borland Interbase Public License v 1.0 at www.ibphoenix.com.

