An ICT Environment for a New Curriculum?

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Abstract

In this paper we describe the development of an ICT environment for a newly developed curriculum at the School of Management and Organization, University of Groningen. The curriculum is highly integrative and requires students to carry out sets of complex practical tasks. These tasks all involve the practical application of scientific theories and models, and require practical skills in elaborate case settings.

Even though the success of the curriculum is contingent upon support by an appropriate ICT environment, the functional and technical requirements for this environment were ‘forgotten’ in the development of the curriculum. Consequently, the courses were not well supported and the environment restricted the success of the curriculum. We describe the environment that was subsequently developed and discuss how this environment will (not) support a complex curriculum.

Introduction

Every five years every curriculum of each department in a Dutch university is evaluated, according to regulations of the ministry of education. The curriculum of the School of Management and Organization, University of Groningen, was evaluated in 1994. Important results of that evaluation were:

• The curriculum prepares students for their second or third job, rather than for their first job. This is due to a lack of practical skills, ranging from a lack of experience with working in groups to lack of practical experience in applying various methodologies for analyzing and diagnosing managerial problems.
• The curriculum leaves a deficiency in understanding the interfaces and interrelationships among the ‘core’ disciplines (such as organizational behavior, finance, production management, and information sciences). Integration of these disciplines should be a very important goal of the program of a School of Management and Organization.
• Not enough (integrated) use of information and communication technology (ICT).

The results of the evaluation had a major impact on the department. Almost instantly, a committee was formed to design an entirely new curriculum that should resolve the points of criticism the ministry of education had voiced in its evaluation report. This committee produced a prototype of a new curriculum, strongly integrative and strongly practical. During the process of designing this prototype, the committee frequently consulted members of industry. This resulted in a strongly practically flavored prototype. Our department has always had strong bonds with industry, many joint research projects have been carried out and thousands of students have done their practical training inside companies. Therefore, it was obvious that industry should have a say in our new curriculum.

Based on this prototype, the department started the development of courses and course material. In the remainder of this paper, the term ‘development’ of the curriculum refers to the process of turning the prototype into an actual program. Even though the prototype was based on a clear view of what the program should look like, many (strategic) decisions still had to be taken.

In this paper, we first give a brief sketch of this new curriculum. From this sketch it will be clear that an
support by an appropriate ICT environment is essential for the curriculum to become a success.

**An impression of the new curriculum**

The new curriculum consists of seven trimesters of compulsory courses. After these seven trimesters, each student chooses a specialization, again consisting of seven compulsory courses, some noncompulsory courses and a thesis (connected to a six-month practical training period in a firm).

The development of the curriculum runs one trimester ahead of the current trimester. As we write this, the first two years (six trimesters) of the new curriculum have been developed. In September 1998, the last compulsory trimester will be implemented, followed by the specializations.

The primary focus of the curriculum is that different disciplines are offered in an integrative fashion. Every trimester consists of two or three basic disciplines and a specifically integrative part: the so-called B/O (in Dutch: Bedrijfskundig integratief Onderwijs). For example, the fourth trimester (second year, first trimester) is depicted in figure 1 (see end of paper).

B/O consists of the integration of several disciplines: organizational behavior, systems theory, research methods and methodology, and communicational skills (such as working in groups, presenting, interviewing, and writing of reports). Every trimester, these disciplines are combined with some of the basic disciplines. For instance, in B/O-4, OB, Systems Theory, and Research Methods are combined with Marketing, External Analysis, and Economic Law. B/O -students work in groups of 12 students on several ‘small’ tasks and a final paper; each group is guided by a supervisor. Each group has its own room with 15 chairs and tables, and with two computers.

It is beyond the scope of this article to give a full description of an entire trimester. Therefore, we will limit ourselves to briefly describe two assignments and a final paper, both taken from the fourth trimester. In the fourth trimester, one company plays a focal role. Every assignment directly or indirectly focuses on this particular company. The company plays an active role in the B/O-courses: Managers from that company give guest lectures, students visit the company, and the company provides a tome of information on its internal processes, strategy, and performance. In the academic year 1997-1998, Elida/Andrélon (part of Unilever) was the focal company, this year the focus is on Avéro, a medium-sized Dutch insurance company.

**Assignment: 'Structural Contingency Theory'**

Structural contingency theory explains the internal organizational structure by considering the influence of a set of so-called ‘contingencies factors’. The contingency factor that is central in the fourth trimester is the external environment of the organization, in particular the complexity and dynamic nature of the organizational environment. The task for subgroups of 4 students is to operationalize complexity and dynamics of the external environment for the focal company (See Appendix 1 for a fuller description of this assignment).

The aim of this assignment is twofold:
- To experience that operationalizing is a (very) difficult task.
- To apply relevant aspects of Organizational Behavior, Organization Theory, External Analysis, and Marketing, in such a way that one could diagnose the fit between the internal structure of the organization and characteristics of its external environment. Moreover, such a diagnosis should yield starting points for redesigning the internal organization and/or an organization’s environment.

In this task only elementary ICT is used, including searching of the web and the sharing of electronic documents.

**Assignment: Decision Behavior of Consumers**

In the intensive week, B/O-subgroups of four students conduct a full-fledged marketing research. They go through all of the stages of “problem formulation-conceptual model-operationalization-conducting a survey-analyzing the collected data–deriving implications for marketing policy-writing a report of the findings, results, and recommendations.” See Appendix 2 for a fuller description of this assignment.

The results of the intensive week form a part of the final paper. For this assignment, several ICT skills are necessary. In order to work together well and finish this research in time, groups need group decision tools, communication tools, need to work with a range of different software, and need to carefully schedule tasks among themselves.

**Final Paper: 'Market Report'**

The final paper in the fourth trimester is a so-called ‘Market report’. In this paper, students diagnose the fit between internal and external organization and strategy. Students also develop a marketing-plan for a particular product of the focal company and discuss legal developments.
The need for groupware and workflow management tools are even more articulate in this final week. The need of an adequate ICT environment to support this task is evident.

Figure 2: A group of students involved in discussion in their own B/O-room.

The ICT Environment

In this section, we will describe the ICT environment that was initially developed for supporting the new curriculum. We will then describe the shortcomings of that environment and outline the ICT environment that was subsequently designed.

From the start of the development of the new curriculum, it was clear that a suitable ICT-environment would be a necessary condition for its success. Until then (i.e. in the pre-B/O era), every student had an account with the central network, located at the Center of Supercomputing. That account gave them access to e-mail, internet, and, most importantly, allowed students to register for participation in exams. In addition, students could connect to the central administrative computer, allowing them to print out a list of their individual grades. Besides the fact that they had access to software such as Microsoft Office, Wordperfect, and SPSS, that was all students could do with the system. Hardly an environment conducive to the integrated study of management and organization.

The development of a new ICT environment took place in two steps. First, an environment was built that was supposed to fulfill all integrative needs. This environment was designed by technicians who had not been involved in the development of the curriculum, and were only partially aware of the structure and content of that curriculum. Second, an entirely new environment was developed, building on the (poor) experiences with the first system. The building of the second system was not anticipated nor expected when building the first.

Below, we will first describe the ICT environment that was initially developed for supporting the new curriculum. After briefly discussing the pros and cons of that system, we will discuss the new ICT environment.

The First ICT Environment

In a separate wing of the building of the School of Management and Organization, rooms were built for groups of 12 students. Each room contained a set of tables, 15 chairs, and two computers. Computers were Pentium 166, with internal harddisks, CD-ROM player, soundcard (a headset was used for multimedia), and were all connected to the BiO-network. This LAN was set up separately from all currently existing networks. It was not connected to the networks at the Center of Supercomputing, it was physically not possible to connect these networks to each other. The BiO-LAN is indirectly connected to the BDK-LAN, which is the network connecting all faculty and staff of the Management School with one another. E-mail messages could be sent between the two networks, which was an important means of communication between the students and their supervisor.

The advantages/strong points of this system are:

- Students had an easy means of communicating with one another. Messages could be sent to other groups with the help of shortcuts.
- All appropriate software was available, correctly configured for the course assignments.
- The network had its own printer, solely accessible to BiO-students. Although the population of BiO-students is large, this did significantly decrease waiting times for printouts.
- Groups were assigned a maximum number of printouts. In this way, printing costs could be controlled.
- Course coordinators could easily send messages to all (or designated) groups, and could place general announcements on electronic noticeboards. Students could easily reply to these messages, making administrative communication fast and efficient (as compared to the pre-BiO system).
- Since each room contained two PC’s and assignments were made in groups of 3-6 students, there was never a lack of available PC’s. Given that each year more than 400 students enroll, PC availability management is an important factor in the logistics of the new curriculum.

The disadvantages/weak points of this system are:

- Although the curriculum is designed to be integrative, the computer environment certainly was not. Software applications lived in isolation in this environment. The noticeboards were integrated within the e-mail facility,
but all other applications were not integrated whatsoever. As a consequence, students sometimes had to run a vast number of separate applications (including converting files) in order to finish their substantive assignments.

- The environment was not inspirational or provocative. Students were very aware of the fact that their curriculum was cutting edge, but were confronted with an environment that looked and felt old-fashioned.
- The system was built in a Windows 3.1 environment, even though most modern software will not run under Win3.1.
- Since the LAN was physically disconnected from the networks at the Center of Supercomputing (RC), students could not access their individual accounts from the B/O-network, nor could they access their group-accounts from the RC-LAN. Moreover, students had to go to different buildings (a twenty-minute walk) in order to access these networks. Consequently, the use of ICT was a lot less efficient and effective than it could and should have been.

A New Environment

From the points mentioned above, it was clear that the first B/O-environment was not appropriate for supporting our new integrated curriculum. A new system would have to be built that would solve the problems experienced with the old system. In addition, since the development of the curriculum was ongoing, the need for additional features had come up. It was clear that these additional features could never be met by the current system. The authors of this paper had already started to bypass the existing environment, by creating their own little intranet. This intranet was built in HTML, and provided students with all of the information needed for the courses. It included the administrative system (so that students could call up their results), had an integrated e-mail system, and contained all transparencies used in class. This intranet certainly was still far removed from the required system, but its conception by an individual course coordinator made visible to everyone that the current system was in a severe need of being replaced. The answer to the question in the title of this paper was a heartfelt ‘no’.

This time, the curriculum coordinators themselves sat down to provide a detailed functional specification for the ICT environment. It soon became clear that the demands on the system were well beyond the capacity of any system currently available at the University. In this new environment, all functional requirements are available; all functionalities related to the integrated nature of the curriculum, are offered in a functionally integrated environment.

Fully functionally integrated system. All functional requirements are available within the same environment. All functionalities related to the integrated nature of the curriculum, are offered in a functionally integrated environment. The system offers tools for workflow management, grade administration, information flow, discussion groups, registration for assignments and courses, possibility to upload and download work documents, registration for expert time, multi media cases, et cetera. All of these tools and functionalities are brought together in a transparent environment, made possible through an underlying extensive database structure that connects login signatures, rights, disk space, and tools.

Fully technically integrated system. The user interface is offered using HTML, including Java. The heart of the system consists of an extensive database, now ACCESS, but in the near future ORACLE. The HTML pages and the database are connected through a Cold Fusion server, using CFML, on a Windows NT server. When a page in a Cold Fusion application is requested by a browser, it is automatically pre-processed by the Cold Fusion Application Server. Based on the CFML in the page, the Application Server executes the application logic, interacts with other server technologies, and then dynamically generates an HTML-page that is returned to the browser. This construction allows the system administrator and course coordinators to easily maintain the system. The Cold Fusion server makes it possible to easily incorporate all kinds of features related to project and workflow management and administration into one transparent user interface.

Logbooks. After students have written logbooks (a weekly assignment in the first year of the curriculum), a logbook can be sent to the supervisor by simply clicking on an onscreen button. The supervisor can annotate student’s texts, and students are able to read these from their individual environment.

Groupware. The system can straightforwardly include all kinds of groupware applications. Currently, only a few course assignments would benefit from groupware. But the 7 coordinators are trampling to incorporate such features into the curriculum. Groupware is very useful in the management-game students play in their third year. In addition, groupware can alleviate the pressures on the staff that derive from the large numbers of students enrolled in the curriculum (recall that every group of 12 students has its own supervisor in each trimester in each year). The supervisor can have students discuss their work and that of other groups online, multiple groups can simultaneously exchange ideas with one supervisor, this
could even be performed from home, either in a distributed or real time fashion.

**Signing up for expert time.** An important feature of the new curriculum is so-called 'expert time'. Groups can consult faculty members with expertise in particular substantive topics. However, in order to manage the availability of these experts, and in order to keep their time investment within reasonable limits, students have to 'buy' expert time. For this, each group has a time budget it can spend on expert time. Groups can put down their code in an available time slot for the expert of choice, until their time budget runs out.

In the 'old' ICT environment, registering for expert time could not be automated. In effect, students were handed out a plastic sheet with strips—each representing amounts of 15 minutes. Experts had an iron ticket puncher with which they literally punched out the number of strips used by students. Unfortunately, groups could register without showing up. This would block the time of strips used by students. Unfortunately, groups could even be performed from home, either in a distributed or real time fashion.

In the new ICT environment, groups can register for expert time through the system. Immediately, the time slot is blocked for other groups and the reserved amount of time is deducted from the group’s time. When a group exceeds its time limit, the system notifies the group and blocks it access to expert time.

Shortly before an expert starts his expert time on a given day, the system generates a list with the codes of the groups. The system also allows groups to list the questions they want to ask the expert. These questions are then incorporated in the listing for the expert, so that the expert can prepare himself better. When a deadline for registering for a particular time slot is reached, the system generates an e-mail message to the expert that contains which groups have registered for what time, and with what question.

**Frequently Asked Questions.** As mentioned above, students can consult experts when working on assignments. These experts then construct FAQs of the questions they encounter during their expert consultations. Also, the course coordinator, who can be reached online, will construct a FAQ on the courses. These FAQs will be constantly updated and can be consulted by all students.

In addition, the system will be able to construct FAQs automatically from the questions provided by the students when registering for expert time. The course coordinator and the experts will then put the answers to these questions on line.

**Multimedia transparencies.** The transparencies that are used in class are made available through the system. Until now, the only type of transparencies that were put on line, were 'static', text/graphic-based sheets. They did not include any sound or movies. However, sounds and movies are used in lectures. Also, some professors use animations in their presentations. All multi-media components that professors use in their classes will now be available for students to view, download, and print (when applicable).

**Teaching on demand.** Currently, multimedia teaching materials are being developed. The intention is that these will eventually replace live teaching in front of large groups. By constructing multimedia teaching materials, students can study subject-matters in different ways (movie of a professor explaining the material, text explanation, case material and so forth). Hopefully these multimedia materials will eventually replace large-scale lectures, primarily for introductory courses. With this new material, the integrative nature of the various topics can effectively be taught. These materials will be incorporated in the new environment, and can be used by students whenever they want (or need) to study particular topics. In effect, this creates 'Teaching On Demand'. For free.

**Easy tracking of use of system.** The system includes various devices that track the 'surfing' behavior of students through the system. In this fashion, we can track what types of information or services are accessed by students, and in what order. Using this information, we gain a wealth of information about the study behavior of students. With this information, we can provide our services more effectively.

**Automated grouping of students.** Depending on their study results, students may (not) be eligible to enter into particular branches of courses. The system is coupled with the central student administration. At the appropriate time, the system takes the names of the students who have fulfilled their entry requirements and allocates them into B/O-groups. In advance, students can tell the system in which courses they want to participate, and at what times. The system then allocates them over groups, taking into account their individual preferences.

**Cases on CD-ROM.** As was discussed in the introduction, one of the main themes in the new curriculum is that companies play a central role in a large part of the assignments. For instance, in the 'market report' we presented above, every year the focus is on another company for an entire trimester. In some cases, students go into companies, in other cases a tome of case material is presented to them. Much of this material is in the form of CD-ROMs. These CD-ROMs contain interviews with company managers and employees, contain movie impressions of production floors inside the
factories of the company, present figures about the market, contain newspaper clippings, and so forth. All this multi media material is readily available through these CD-ROMs and is fully supported by the computer system.

Shared files. The system allows students to upload files to the server. They can then access these files through the internet, work on them and upload new versions. In this way, groups of students can work on documents together, without having to be in the same place. This feature is useful for two reasons. First, since the Center of Supercomputing and the BiO-LAN server are not physically connected, students can otherwise not access their files from the Center. Since students often work at the Center’s computers, internet access to their files provides them with a way to save their files in a central location, without the necessity of a direct physical connection of both servers. Second, since tasks often span multiple weeks, and include interrelated subtasks carried out by different group-members, a central location of files allows group members to remain up-to-date on the progress of each other’s work and the chance to work together without physically having to be at the same place.

An ICT Environment for a New Curriculum?

In the previous section, we gave some examples of tasks students carry out during the fourth trimester. These tasks need extensive ICT support in order to be carried out well. Especially since the timely completion of these tasks requires sound project and workflow management, students need to be offered the tools to support them. For the course coordinators, necessary requirements fulfilled by the system include that the entire course administrative system is incorporated in the ICT environment, assignments can be handed out electronically, grading can occur electronically, the various grades students acquire throughout the trimester can be aggregated to final grades, course supervisors (between 12 to 35 per trimester!) can be notified of important information, students can be assigned to groups based on various characteristics, and the progress of students can easily be tracked.

The curriculum, and the ICT environment we are developing, is revolutionary—at least for Dutch standards. In such cases, there hardly are previous scenarios to learn from. Every mistake that can be made, will therefore be made. A clear mistake was the way the original ICT environment was set up. In the development of that environment, the requirements of the new curriculum were not taken into consideration. Rather, the old curriculum was taken as a starting point, and, consequently, the environment was a failure on almost every account. Of course we learned from that. We might do better with the new ICT environment. However, there are several problems ahead of us.

First, the faculty of our school now have to work under Windows95. A surprisingly large part of the faculty still works with Windows3.1 and even uses software like WordPerfect 5.1. For them, the switch to Win95 (necessary for compatibility with the BiO -environment) evokes much frustration. Learning new software is not always easy, problematic conversion of documents creates even more frustration. It will take over a year before the commotion will have settled down.

Second, the functional specifications of the new system have been established by the course coordinators. However, these coordinators were not involved in the technical design of the environment. As a consequence, technical decisions have been made that are likely to affect the way the curriculum can develop in the (near) future. As we mentioned above, the development of the curriculum is an ongoing process. Trimesters are developed one trimester ahead of the one that is currently running. Moreover, new courses in such a complex curriculum need to be redesigned constantly, until all ‘childhood diseases’ are cured. At this point, it is unclear whether the technical specification of the new ICT environment is flexible enough to accommodate the curriculum to grow to adolescence.

Finally, the ICT environment has only (partially) been tested with small groups of students. However, every year, around 500 freshmen enroll our program. In September 1999, around 1000 students will simultaneously be in various parts of our BiO-courses. This number will increase. It is unclear whether the system will be able to error-free handle traffic among so many simultaneous users.
At the 1999 HICSS conference, we will present the new environment and discuss how well it (seems to) support our complex and challenging requirements. No doubt, this new environment will be a source of sorrow and pleasure for the new curriculum. Only the future will tell if we can replace the question mark—in the title of this paper—to an exclamation mark.

Appendix 1. Assignment: ‘Structural Contingency Theory’

Beforehand:
- Students are provided with a case description. This description includes the mission statement, marketing strategy, and a discussion of the formal organization of the Dutch insurance company Avéro.
- Literature is provided on:
  - Structural Contingency Theory;
  - How to operationalize abstract theoretical constructs;
  - How to build conceptual models.

Student assignment
In this exercise you will operationalize parts of the Structural Contingency Theory. You will use the results of this exercise in the Market Report you will write as your final assignment for this course. Your group is asked to operationalize the following concepts:
- ‘Market dynamics’,
- ‘Market complexity’,
- ‘Organic organization structure’,
- ‘Mechanistic organization structure’, and
- ‘Organizational effectivity’.
All of these operationalizations should be applicable for Avéro.

The exercise consists of four parts:
1. Formulate a research question based on the case description leading to a contingency analysis.
2. Define and operationalize ‘market complexity’ and ‘market dynamics’. Provide an accompanying conceptual model.
3. Define and operationalize ‘organic organization structure’ and ‘mechanistic organization structure’. Provide an accompanying conceptual model.
4. Formulate at least three different definitions and three different ways to measure organizational effectivity.

Defend your choices by considering:
- Which limitations do your choices have?
- What is the aggregation level?
- How and where can you collect the necessary data?
- What are the assumptions? Are they realistic?
- What are the strengths weaknesses in the given operationalizations?
[The students also get a time schedule for completing this assignment and a correction model that is used for grading and feedback.]

Appendix 2. Assignment: ‘Decision Behavior of Consumers’

Beforehand:
- Students are provided with literature on consumer behavior and consumer decision making processes.
- Literature is provided on market research methods and methodology.
- A remedial course on the use of the statistical package SPSS is optional.
- During the student assignment several crash courses on the research process—especially on how to construct a good and relevant questionnaire—are obligatory.

Student assignment
This part of the assignment is focused on the processes underlying ‘buying decisions’ of potential consumers. You have to formulate:
- A research question leading to a market research on consumer decision processes for the central case of this trimester,
- The definitions, delineation, and operationalization of all relevant variables in your research,
- Accompanying conceptual models.

Be precise, so in the FIRST PART you have to take into account the usability of your proposed research for you Market Report (the final assignment); you have to formulate at least three subquestions. You should also explicitly formulate the limitations and the assumptions. In the SECOND PART you give the necessary definitions. You also have to take into account ‘reliability’ and ‘validity’ of your measurements. In the THIRD PART it is necessary to describe (directed) relations

On the basis of the above you make:
- A data-requirements table (see literature),
- A self-administered questionnaire,
- A plan for analysis of the data.
Plan your work on the basis of the crash courses.
Based on the above, the students go through the entire research process. They start with formulating research questions, based on problems encountered by insurance company Avéro. Students then come up with hypotheses—building on the marketing literature—and test them by constructing and administering a questionnaire 'on the street'. They then analyze the data collected through these questionnaires, using the knowledge of statistics and methodology of earlier courses. Finally, they write a report that includes management recommendations.

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Figure 1. The fourth trimester of the new curriculum of Management and Organization