

Models for web-based education: have we forgotten lessons learned?

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Summary

The fact that for the first time a virtual university has been formally accredited is taken as a starting point for the discussion about reasons for introducing this educational format. A further growth in such initiatives is predicted. But at the same time, arguments are put forward urging care in adopting this educational format. Two major issues are dealt with: (i) why an institute should extend its educational approach with web-based education and (ii) to what extent the adoption of web-based education is in line with the education format adopted thus far. Congruency in educational formats should be strived for, as should careful planning in introducing innovative educational formats that are not yet consistent with the educational approaches adopted thus far. Examples of educational models and the ways that they are mirrored in web-based education are discussed. Three stages in the overall innovation process are distinguished: substitution, optimization and transformation. Although information and communication technology has the potential to support the final transformation stage, care must be taken to ensure that the dominant educational model that is adopted in current education is congruent with the innovation aimed for.

Introduction

At last, it has happened. A virtual university has been accredited by the North Central Association of Colleges and Schools: the North American Jones International University (JIU). Although other universities already offer courses on the Internet, their approach is only an additional component, or only for postgraduate courses and/or non-credit courses. Most initiatives only have a public-relation function.

But with this first official accreditation of JIU, a milestone has been reached in breaking down barriers to the growth of this new educational format. As a new initiative the JIU does not have to take into account existing constraints that currently hinder institutes to move towards online learning and web-based education: infrastructure, existing educational formats, profiles and culture of current student population, professional status of staff etc. Its pricing strategy is competitive because investment in infrastructure is negligible compared with

traditional institutes. Moreover, the JIU builds on the work of lecturers at famous institutes such as Stanford and Berkeley.

The question now is how other educational institutes will react. Is it predictable that more and more such virtual educational institutes will be launched? What about existing educational institutes? Will they all have to move in this direction? In this chapter caution is asked for in adopting too quickly web-based education as a dominant educational format. The first question concerns why web-based education should be adopted. The second question concerns the congruency between the current educational approach and the educational approach one intends to adopt when pursuing web-based education.

Why web-based education?

Collis [1] presents four main reasons for adopting web-based education. The first is the need to re-affirm some basic principles of good teaching and learning: active engagement of the learner, assessment of competencies based on a communication-oriented pedagogy, scaffolding of learning processes, variety in feedback and efficiency reasons (individual pace). The second reason relates to changing student demographics: the characteristics of students are so varied that the traditional approach based upon the homogeneous nature of the target group is no longer valid. The differences are related to age, educational background, experience, culture, native language etc. Third is the need for more flexibility: Collis et al. [2] distinguish between 23 types of flexibility. The most important reasons to pursue flexibility are related to (i) where you want to study, (ii) when to study and to take assignments, (iii) what to study in relation to individual needs, interests or prior knowledge, (iv) the amount of communication required and (v) adaptation of assignments to workplace duties. As a consequence web-based education is offered especially in relation to the following variables: location, programme, types of interaction, forms of communication and study materials. The final reason is providing professional and academic leadership. Educational institutes have a responsibility to model adequate methods of teaching and learning and thus give learners experience with new ways of dealing with knowledge. In this way they themselves can rely on a richer repository of possible teaching and learning formats in the future.

Comparing the JIU with these four reasons to adopt web-based education, we see that the 'flexibility' issue is of prime importance. JIU attracts students with full-time jobs or who live too far from existing institutes. This observation is also in line with the fact that institutes that traditionally cope with the flexibility issue adopt web-based education more easily. Open universities and distance-education institutes have nowadays well-established approaches to web-based education. But these institutes are also in stages of transition and have not yet moved completely towards web-based education.

Diagnosing your institute

Putting the 'why' question in front of all other issues is consistent with systems approaches to instructional design and is central in the first two phases of such a design approach. (i) State the problem. Look for the real needs, state priorities and formulate the main problem to be dealt with. (ii) Analyse your environment/the context. Consult all 'problem owners', those involved in the situation, check the conditions (procedural, organizational, technical, financial etc.) and consult available resources (books, articles, the Internet etc.). Such analysis brings Romiszowsky [3] to opt for self-directed and just-in-time learning, self-directed knowledge acquisition and hypermedia, metacognitive skills of information analysis and skills of creative problem solving.

This focus on a careful examination of these first stages in instructional design results in a critique of a number of web-education design approaches that take these phases for granted and immediately focus upon the design of the web and only consider micro-issues. In recent literature, a number of authors have presented design approaches that clearly respect the first two stages, e.g. Gillani [4] and Khan [5,6].

Put another way, a systems design approach includes self-reflective activities of your institute relating to a number of key questions that paraphrase the 'why' issues that were discussed above.

- Is there a need in your educational setting to re-affirm some basic principles of good teaching and learning? In other words, does your institute pursue the active engagement of the learner, a communication-oriented pedagogy, scaffolding of learning processes instead of expository approaches by lecturers, variety in feedback and methods to individualize the pacing of learning processes (efficiency reasons)?
- Is your institute confronted with changing student demographics, such as differences in age levels, different educational background, very different prior experiences, a variety of cultural background or different languages?
- Is there a need to pursue flexibility? Do you cope with students that ask to study from different locations, that want to study individual programmes, that ask for a variety of types of interaction, that need different forms of communication and expect to receive study materials in line with their needs?
- Do you want or have to pursue professional and/or academic leadership?

Flexibility as an answer to the 'why' question

Considering the issue of priority in a systems-design approach to instruction, the second and third questions above have to receive major attention. Especially when institutes want to attract more students, the outcome is a growing diversity in student characteristics. For example, at the University of Gent students that already possess a higher professional education diploma are allowed to skip parts of the introductory programme. In this shortened programme, they study a subset of selected courses of the first and second years in one academic year. But, this special curriculum design is not reflected in the way courses are taught. These

students follow the same courses as other students in the first and second years. As a result, they are confronted with changing peer groups, different planning approaches and difficult schedules. The fact that this group consists of professionals that already have jobs and families is not taken into account. The specific needs of this special student group are not addressed, with a number of negative consequences; dropping out, lower satisfaction and even alienation.

When differences in student characteristics are found to be important enough to take into consideration, the next question is in what way does the institute intend to take these differences into account? Different objectives? Different learning materials? Different learning activities? Different times? Different locations? Considering the amount of work in dealing with these answers, designing web-based education might be an efficient way to tackle the issue.

Pursuing innovative educational models as an answer to the 'why' question

When the focus is on the second and fourth questions in the 'why' checklist, we enter an entirely different kind of discussion. In this case institutes promote a major shift in their educational approach. Institutes that move in this direction have, first of all, to be aware of their current dominant educational model and have to realize that moving towards new models is not easy, as will be explained later in this chapter. This is the main reason why we ask for careful and planned innovation.

In this context, Kirschner et al. [7] distinguish between three levels of change: substitution, innovation and transformation. Adoption of web-based education remains, in a large number of situations, restricted to substitution. This means that a limited number of processes and variables of the educational setting have been affected by the use of the web. For instance, all information about the study programmes can now be found on the web, and all the course materials are published electronically on the web (electronic study books). It could be said that this substitution approach pursues an optimization of the current dominant educational model.

Innovation has a greater impact. A larger set of processes and variables at the micro- and meso-levels are affected: more actors are involved (e.g. teachers, students, teams, support staff and administrative staff). The innovation goes beyond a single course and influences the curriculum structure, organization and content. But the innovation is still realized within the boundaries of a large number of meso- and macro-level constraints. For example, the timing of the educational programme remains intact and final assessment is still the dominant evaluation approach. The use of information and communication technology (ICT) is important to support this change level but is not the decisive factor in the implementation of the innovation.

At a third level, the authors [7] consider transformation. In this case, the complete institutional design and approach is affected by the innovation. Curricula, assessment, support provisions, types of staff, staff roles and responsibilities, administration and pacing are affected and this has an effect up to the

| Substitution | Innovation | Transformation |
|--------------------------------|--------------------------------|--|
| Technical issues | Didactical issues | Educational model and educational management |
| Course level | Curriculum level | Organization level |
| Individual instructor /teacher | Educational support staff/unit | Management |

Different accents in change levels

Table 1

macro-level of the education and training approach. In a transformation model, the change is built completely upon the potential of ICT. Jochems [8] illustrates the differences between the three change levels in Table 1. He indicates what features are stressed at each level of change.

The 'dream' of a high number of educational institutes is to reach this transformation stage. In this approach, a fundamental new concept of education has been adopted and implemented. Such transformative instructional approaches are to a certain extent already present in the educational field. There follow a few examples to direct the reader's thoughts. Bonk and Cummings [9] write about deep student engagement, and public and private forms of feedback, and suggest that you facilitate and don't dictate, embed thinking skills and portfolio assessment, and vary forms of mentoring and apprenticeship. Doherty [10] stresses dynamic interaction, communication and all types of presentation. Gilbert and Moore [11] stress social and instructional interactivity between students and between students and teachers/lecturers. Wiens and Gunter [12] stress offering different modalities when presenting information to promote interactive discovery learning.

The examples show a variety of promising new directions, but the question is, what is the congruency between the current educational model and the innovative model that we are looking for? Is your institution ready for this new approach? Have your students experience with the new educational model advocated by your idea about web-based education? What about your colleagues? What about current provisions, support staff, assessment approaches etc? In other words, is immediately jumping to the transformation level the right decision?

Educational models and web-based education

The JIU has only existed for 4 years and was explicitly designed as an online learning institute. Most educational institutes have a history and during this time they have developed an educational approach in line with the available infrastructure, characteristics of the student population, the professional status of the staff etc. Introducing web-based education in such institutes is not straightforward. This is why, next to the 'why' question, a very conscious approach should be stressed regarding the educational model that institutes adopt when introducing online learning. We accept the potential of web-based education but insist on looking for congruency between existing educational models and models being introduced by adopting web-based education. This is not advocating traditional approaches, nor is it neglecting the statement of Collis [1] regarding the

provision of professional and academic leadership. This is why there should be caution and a clear awareness of the educational consequences when certain types of web-based education are introduced.

Educational models: an overview

Table 2 summarizes a number of key features of three dominant educational models that influence current educational practice and affect the procedural, functional and material organization of instruction [13]. In relation to behaviourism, cognitivism and constructivism, we look at the role of the teacher/lecturer, the role of the learner, the characteristics of the learner and the teacher/lecturer, the view on the learning process, the view on the instructional approach and the role of the context.

The natural fit between innovative educational models and web-based education

When we consider Table 2, it is clear that the constructivist model has yet not been realized fully in current educational practice. But this model is the dominant model behind most web-based education approaches. Corrent-Agostinho et al. [14] present web-based learning as a problem-based learning approach. Harasim et al. [15] indicate that online learning is clearly associated with active learning and active participation by students, interactive learning and peer-to-peer discussion and exchange, and multiple perspectives; input from all other online students as well as the instructor. Bonk and Reynolds [16] associate web-based learning with a learner-centred pedagogy, creative thinking and co-operative learning, and learning apprenticeships and student perspective taking. Relan and Gillani [17] contrast traditional education and web-based education, and, in relation to the latter, they stress experiential learning, co-operative learning, dynamic resources and individualization.

To many educators, these descriptions are attractive and even seductive to the extent that they wish to introduce web-based education as an alibi for changing the dominant educational model in their institute. The latter would imply that changes in educational approaches are introduced in an implicit way. But the latter approach can't be advocated. This would result in incongruency between the existing model and the new model and in difficulties at the micro- and meso-levels. In a recent study I analysed the impact of introducing web-based education in a traditional university [18]. The results indicate that although the innovation built upon the right expectation as to technical issues, there were concrete problems related to incongruity at the level of the educational model. Students perceive a shift in educational culture. For example, introducing a web-based course in the first academic year that builds upon personal activities of the students is in sharp contrast to the dominant instructional model that they experience in other courses (<http://allserv.rug.ac.be/~mvalcke/Onderwijskunde/index.htm>). The strong emphasis on student involvement was judged by the

Table 2

| | Behaviourist model | Cognitivist model | Constructivist model |
|-------------------------------------|--|--|---|
| Teacher/lecturer | In control of the complete learning/teaching setting. | Controls the process. Follows a strict design process. | Is a coach, a facilitator. Designs authentic contexts. |
| Learner | Individual learning is an outcome of the instructional activities of the teacher/lecturer. | To an extent, acts as a coach for the learner. Individual learning process is of central concern. | Controls the learning process. Is part of a social context, a team. Takes responsibility for the learning process. |
| Characteristics of the learner | No special attention paid to characteristics of individual learners. | Instructional process builds on prior knowledge of the learner. | Own experiences; interpretation and problems are a point of departure for learning. Individual cultural background can play a role. |
| Characteristics of teacher/lecturer | Educational professional. | Educational professional. | Can be a professional, an expert in a certain field and not a teacher/lecturer. |
| Learning activities | Learning is always a consequence of the instructional activities. | Learning implies active processing of information (presented by teacher/lecturer) by the individual. | Knowledge is a process that is acquired in a personal way by each individual and in social contexts. |
| Instructional activities | Teacher/lecturer defines instructional objectives. | Explication of objectives by teacher/lecturer. | Higher-order objectives are pursued, such as problem solving. |

Key features of three basic educational models

(contd.)

Table 2 (contd.)

| | Behaviourist model | Cognitivist model | Constructivist model |
|---------|--|---|--|
| Context | Pre-structured activities that build upon a systematic breakdown of the knowledge domain pursued. Major attention for structure in especially elaborated learning materials. Assessment by teacher/lecturer at each level. | Task analysis of complex processes. Structure and sequence of instructional activities based on the task analysis. A variety of instructional strategies is adopted to promote the construction of schemas. A variety of media usage is pursued (presentation formats). Prior knowledge is assessed and activated. Continuous assessment to guide the individual learning process. Informative, object-linked feedback. | Builds on student experiences. Respects student learning style. Design of learning environment is essential. Use of real-life learning materials that reflect full complexity and multiple perspectives. Learning is put in a social context. Involvement with real world. Activities: discussion, role play, collaboration, construction activities. Self- and peer assessment. Consideration for knowledge acquired in non-formal settings (intake, portfolio, certification). The real, complex, world is the educational context. Teacher/instructors pre-structure this context as "learning environments". |

Key features of three basic educational models

students as an assessment approach. This caused stress and reluctance to participate. It took time to explain to the students the (new) objectives, the role and function of the resources on the web, the role of student involvement, the nature of the assessment etc. Even months after 'running' the course there were students who insisted on buying an official printed textbook.

The new approach put heavy demands on the university, the infrastructure of which was not set up for this kind of use. In this first-year course, over 800 students participated in the lessons. The faculty offered limited facilities: approximately 50 up-to-date computers. Moreover, these facilities were not always accessible as the room was occasionally reserved for teaching activities.

The innovation reflected a shift in the nature of the objectives. In the traditional approach especially, insight in concepts and instructional theories was pursued. The new course design reflected a strong emphasis on the application of principles and theories in real-life settings.

A number of recent studies confirm the problems that institutes face because of this incongruency. For example, Collis and Van der Wende [19] set up an international comparative study (Europe, U.S.A. and Australia) and refer, for example, to the conflict between policies (choices, priorities) at the micro-level and policies at the meso- and macro-levels, and to the conflict between the micro- and meso-levels in terms of educational and organizational staff support (professional training, incentives) and quality indices. Micro-level developments go far beyond the availability of the support provisions. With regard to quality, actors seem to stress different performance indicators. There is clearly a lack of performance indicators that are in line with the particularities of ICT use.

In their recommendations, Collis and Van der Wende [19] clearly refer to the statement made earlier to adopt a careful change process and to involve actors, working at the different levels of aggregation: the national, institutional and teacher/instructor levels. The findings of this research are confirmed by a comparable, recent study [20].

Looking for congruency

Comparable with the way I dealt with the 'why' question, I also propose to diagnose the educational model of your institute. Table 3 helps to determine one's educational model. Depending on the total score, the predominant model is behaviourist (<10), cognitivist (10–16) or constructivist (>16). This mapping of educational models and web-based education can also be based on the set of dimensions of interactive learning, as discussed by Reeves and Reeves [21] and shown in Figure 1. An educational approach that is towards the left of the continua is more behaviourist. This activity does not imply a value judgement about the educational approach adopted. There are many reasons for adopting a rather cognitivist and/or a behaviourist approach. Our aim is only to develop a clear awareness of this approach. Moreover, even when diagnosing a behaviourist approach, congruent web-based education applications are available.

This brings us to our central statement about congruency: look for web-based approaches that are consistent with the current educational model and

| Variable | Value (score) |
|---|--|
| The role of the teacher/lecturer | Designs the learning situation (1) Controls the learning process (2) Guides the learning process (3) Scaffolds the learning process (4) |
| Characteristics of the teacher/lecturer | Educational professional (1) Content expert (2) Professional (3) |
| The role of the learner | Follows the teaching process (1) Activity and creativity on demand (2) Spontaneous activity (3) Control of individual learning process (4) |
| Characteristics of the learner | No differences taken into account (1) Limited number of differences taken into account (2) Learner determines needs to be dealt with (3) |
| View on the learning process | Result of teaching activity (1) Limited autonomy of the learner; active processing of information offered (2) Personal activity in a social context (3) |
| View on the instructional approach | Goal-driven by teacher/lecturer; well prepared learning materials; focus on assessment of observable learning outcomes by teacher/lecturer (1) Goal-driven, selected and prepared materials, various presentation formats, task-analysis; continuous assessment, respect for prior knowledge (2) Goal definition by learner, focus on active processing in collaborative settings, self- and peer assessment, real-life learning materials (3) |
| Role of the context | Not considered (1) Considered in view of its representation value (2) Essential; base for learning materials and activities (3) |

Base for a congruency checklist

consider this as a first stage to move forward towards more innovative approaches. In this process, thinking about education becomes a shared activity of actors in the educational institute. This prepares these actors (the problem owners) for a further thorough rethinking that might introduce transformation-level changes into the discussion.

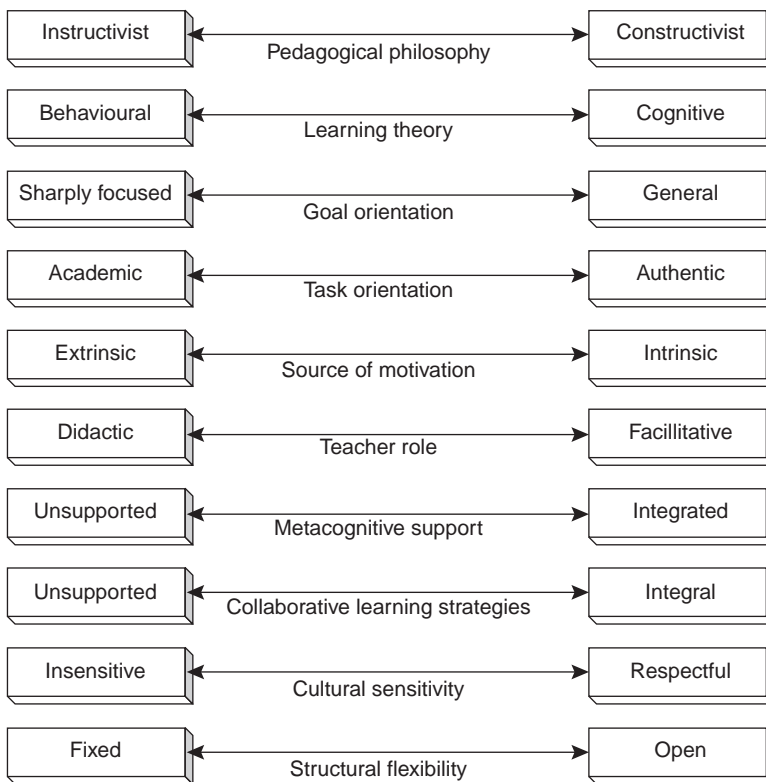


Figure 1

Dimensions in mapping educational models

Educational models and web-based education

Bannan-Ritland et al. [22] present in this context an adequate classification that structures web-based educational applications along a continuum from behaviourist to constructivist types of use. Table 4 gives an outline of this continuum. The structure of Table 4 is clear since the approach depicted in the initial row limits the educational experience to information delivery. Gradually, along the other five rows, this changes into a setting that offers immersive instructional experiences to learners, in line with the powerful learning environments pursued by constructivist theorists. The six levels also represent very different instrumental approaches to the types of communication and interaction between learners and between learners and teachers/lecturers.

An example

The Dutch Open University (Open Universiteit Nederland, OUNL) is a distance-teaching university with a long tradition in delivering second-generation distance education. This means that this university adopted a very 'industrial

Table 4

| Type of framework | Instructional description | Web/Internet activities | Components and tools |
|---|---|---|--|
| Information delivery | Delivery of information to students. | Posting of course-related information such as syllabi notes and assignments. | Instructor-selected web links. |
| Information delivery with pre-defined resources | Provision of pre-defined links for students to explore. Identification of outside resources. Organization and delivery of instructional activities. | Organization of web resources and links by class instructor. Slides and handouts posted for use during course. Links to external digital library texts. | Instructor-selected web links. Web-converted presentation slides/web-based digital library texts. |
| Information delivery with online interaction | Computer-mediated communication. Asynchronous and synchronous communication. Primarily text-based interaction. | Interactive, online communication among students and instructors including guidance, discussion and answers to posted questions. | E-mail. List servers. Computer conferencing. Internet chat relay. |
| Pre-designed instructional delivery | Self-contained instructional modules for student access and downloading. | Instructional modules including presentation of information, interaction and feedback related to specific content. | Web-based tutorials. Multimedia modules delivered via the web. |
| Information synthesis and creation of resources | Student-based information synthesis and creation of resources. | Development of web pages related to the course content. Location and creation of web resources and links. | Student-created web links and sites. |
| Immersive collaborative environments | Text-based and visual environments. Facilitation of collaborative learning. Accessible by multiple users. | Assumption of roles by students and instructors for interaction within collaborative environments. | Computer conferencing tools. Text and visual chat rooms. |

Relationship between educational model component and its 'translation' in the ICT environment

approach' to the design, development and exploitation of its education. Up to 80% of financial resources were invested in the design of learning materials that were delivered to students as comprehensive packages. These packages contained specially printed learning materials with a detailed elaboration at content level and at didactical level. Up to 45% of the materials consist of embedded support devices (ESDs) that help students to get access to the materials (advance organizers, introductions, content structures), to process the new knowledge (cases, tasks, examples, schemes) and test mastery towards the objectives (pre-questions, self-tests). We have already presented a critique of this second-generation approach elsewhere [23].

About 3 years ago the OUNL decided to move gradually towards a third generation of distance education. This third generation can be characterized by the following key words: flexible learning materials, competency-based education, assessment as a corner stone, collaborative learning and completely Internet-based. The development and implementation of this new learning and working environment was set up in three stages.

Stage 1

In September 1997, the OUNL website was launched (<http://www.ou.nl>; an English-language tour is available). This first vast site contained very broad information for students, staff and those interested in studying at the OUNL.

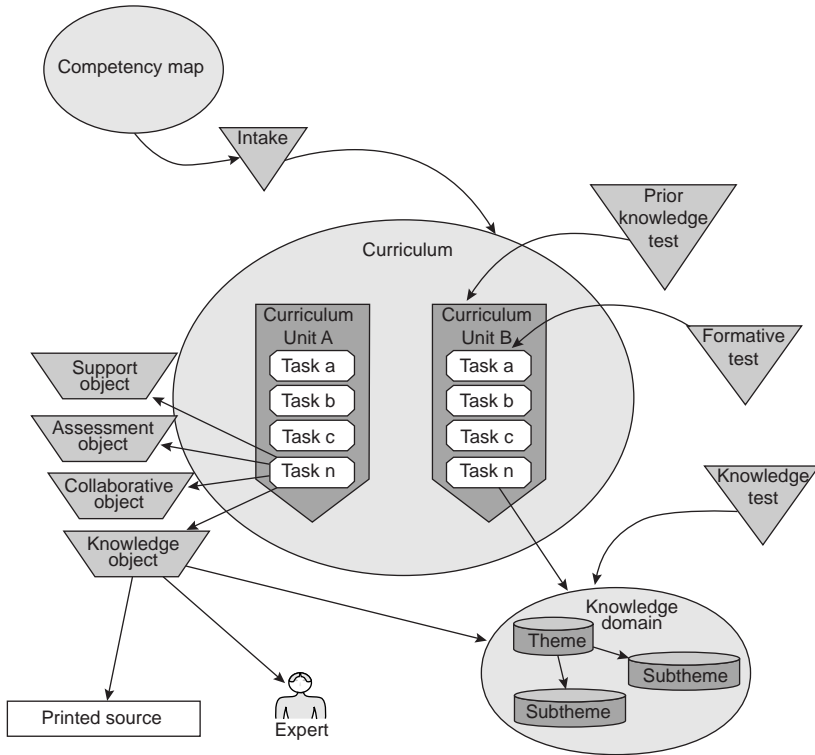
Four subwebsites are available. Infonet (also available in English) contains official information about studying at the OUNL. Of great interest are introduction sites for specific study programmes at the OUNL. Interested students can look at materials, study an introductory sample and take a sample examination. Intake tests are available to test for the required prior knowledge, such as technical English, mathematics and scientific Dutch. Opennet contains webpages of staff, student societies and projects. This information presented here is the responsibility of the designer of the web. Huisnet is the intranet website for staff. There is no access for external users to this site. Studienet is the biggest subwebsite and the core of this first stage. Students who have subscribed can access their own personal study environments. Based on their subscription, this environment builds upon the specific set of courses that they are studying. In this way, students get access to course descriptions, course-related discussions and newsgroups, personal mail, updates of course materials, the ability to download software etc.

In a way, this first-stage web-based university is a very effective and efficient transformation of the existing educational approach into an electronic version. But there are already new features available. In particular, the fact that the Studienet is personalized and can be a very powerful study environment is an addition to the existing educational approach, which already mirrors the potential of what lies ahead.

Stage 2

In 1998, considering the re-design of a number of OUNL courses, a number of new features were added to Studienet that built upon synchronous communication: audiographics and groupware. These new features were not, as yet,

Figure 2



The competency-based educational model

considered as generic tools available for all courses. A more careful path was chosen by building upon a structured re-engineering of specific courses in experimental settings. In this way, the OUNL could guarantee that implementation would be successful in aspects such as training of staff, upgrading of infrastructure and re-design of the courses (objectives, materials, tasks, assessment etc.). Examples of such courses are International Law, Management Sciences and Virtual Enterprises in the field of the Natural Sciences.

Compared with the Stage 1 website, this web-based educational model was a big step towards attaining certain constructivist principles of learning and instruction.

Stage 3

In 1999 it was decided to move forward and set up a large-scale project involving complete re-engineering of OUNL's educational model; design and development of EDUBOX (at the start the name ELON was adopted). EDUBOX will not only result in a working and learning environment that is completely electronic, but will also redefine the instructional approach. Figure 2 briefly explains the basics of this new educational model. The curriculum structure is based on a

competency map, which consists of tasks that help students to attain the competencies required.

Each task consists of specific objects: support objects (tutor, other students, expert), collaborative objects (to work on the task with other students in a groupware environment), knowledge objects (experts, electronic learning materials, books, other multimedia) and assessment objects. Figure 2 shows how assessment is a recurrent feature in the complete learning environment. Assessment directs, in the intake phase, the negotiation process to define a student's individual curriculum. Assessment helps to measure prior knowledge, and strengths and weaknesses. Special tests measure mastery of requisite domain knowledge needed to complete the task. Assessment also helps to determine whether the competency has been attained.

The system should not only be discussed from a student's point of view: other perspectives are important, such as that of the tutor, content specialist, competency map developer, assessment developer, media developer and groups of students. This means that EDUBOX also offers specific working environments for these actors. When they are given access to the environment they get tasks in relation to maintaining the system, developing study tasks, elaborating electronic learning materials, developing test items, managing student progress etc. As far as content management is concerned, EDUBOX offers content developers a powerful tool to develop and store these materials in an XML-format. This offers the advantage that the materials can be used in a variety of electronic learning environments and can easily be transferred to other media. For more information contact info@edubox.nl.

Conclusions

In this chapter I have urged caution in adopting web-based education in existing educational institutes. I first gave careful consideration to why web-based education should be adopted. Next, I appealed for congruency in the educational model that is followed in the current educational approach as compared with the web-based education that is pursued. I have tried to stress the fact that the demand for caution is not inspired by a reluctance to embrace web-based education. An example was elaborated to show how building upon an existing educational model is not in conflict with gradually moving towards the constructivist model for web-based education.

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