EDUCATING ICT IN CONTEXT

Plessius, Henk [1] , and Vodegel, Frans [1]

[1] University of professional Education, Utrecht, the Netherlands. *Email* : henk.plessius@hvu.nl

ABSTRACT

ICT-programs in universities focus on ICT-topics like software engineering, computers and networking, etc. After graduating most students discover that their knowledge of ICT is only valuable within the context of the business in which they are participating: ICT has to play its part in the struggle for more productivity.
In the Netherlands a program has been started (in cooperation with the Dutch Digital University) to present ICT-knowledge in a context unique to the domain the student has chosen. This can be reached by decoupling ICT-content and context. For example: to a technical oriented student and a more management oriented student the same ICT-content may be presented (let us say on databases), but in a different context, resulting - from a student´s viewpoint - in different texts, different applications, different examples, etc.
For a start four different contexts have been defined (software engineering, technical/industrial, communication-oriented and managerial), a number which can easily be extended. (for example: medical or law)
A very important first step in the development of the proposed system (called CAIO which stands for *Context Afhankelijk ICT Onderwijs* i.e. Educating ICT in Context) is finding agreement on which ICT-knowledge is expected from everyone who works in the ICT-business (the Common Body of Knowledge). Probably every expert will have a different answer to that question so we accept the fact that the common domain has no very sharp boundary and we will provide individuals with the possibility to extend or limit the chosen topics.

In our paper and presentation we will elaborate on the architecture of such a system and the way it supports different didactical approaches. In the presentation we will show examples of realised content as the first results are expected in the summer of 2005.

1. INTRODUCTION

In the Netherlands, higher professional and university ICT education is changing. A wide variety of courses is converging on the broader Bachelor of ICT (BICT). A broader discipline like this one is characterised by a common core curriculum, to which a number of specialized profiles are added. In this article, we focus on profiles featuring a type of ICT that is applied in the context of a certain profession. This calls for another organisation of ICT education. The CAIO project intends to tackle this issue.

The Bachelor-Master structure that is introduced in Dutch higher education is resulting in a large-scale revision of curricula. This also applies to ICT education. In addition, there is a growing need to develop professional education based on competences, because this is the only way to strengthen the relationship between education and the professional environment [van Asselt, 2004]. If we add to this the current didactical views and the rise of new electronic tools, we find that a new type of education is developing where students, are working in teams on real-life assignments. The necessary knowledge is available 'on demand'. This type of education, which is more customer-oriented, is resulting in more individual learning paths: students are undergoing different experiences at different moments. In ICT practice, these learning paths are leading towards the different application areas of ICT, for example technology, communication, management and the health services. In this article, we will refer to these as the 'context', i.e. the professional environment in which the ICT specialist operates.

This project is one of the most important cornerstones of the national programme for ICT education in the Netherlands (SPIoN) [Vodegel, 2004], a programme of the Dutch Digital University, the DU (Digitale Universiteit). Many more digital learning materials are being developed in national collaboration, which can be divided in four sections:

- *Digital testing, assessments and digital portfolio*
- *Digital educational tools: tasks and resources*
- *Distance-Learning and -coaching: dual, virtual and international*
- *Develop and distribute expertise*

The Digital University (www.digiuni.nl) is a consortium of ten universities in the Netherlands. It focuses on the development and application of digital educational products and knowledge for higher education. Important

issues for the Digitale Universiteit are a changing demand for education, combining working and learning, permanent education, the role of e-learning and the need for cooperation.
In most institutes of higher education the challenge is: educate more students with less money, offer better quality and use modern technology at the same time. The Digitale Universiteit aims to set up a relevant knowledge network, share expertise and, last but not least, share the financial burden of innovation.

2.   OBJECTIVE

In the case of ICT education, this means that the development of the curriculum will result in a common core, which is followed by all students, supplemented with a specialisation in a certain context, allowing personal accents. This is in line with the general movement in Dutch higher professional education towards a much broader Bachelor degree, such as the Bachelor of Information and Communication, in which 40 percent concentrates on general ICT competences, 30 percent on the context, and a further 30 percent is dependent on the personal interests of the student, combined with adjacent fields of study [Vissers, 2004]. CAIO, Context-Related ICT Education, anticipates these developments.

Objective of the CAIO project is to develop a content database, which can be accessed through electronic learning environments. In time, this database will include a vast amount of relevant, common ICT knowledge relating to the broad BICT education, allowing knowledge from different contexts to be accessed.

> What does context-related mean? An example: the term 'requirements' might be explained as follows:
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> • for the ICT-student in a business context:
> The requirements describe in natural language, where necessary complemented with diagrams, the functions that the system must be able to carry out.
> • for the ICT-student in a Techical context:
> The requirements are an exact specification of the functions, services and operational constraints of the system.

3.   CAIO and didactics

One of the basic requirements to the CAIO project is that it is didactically neutral. As indicated above, CAIO primarily originated from the need to produce competence-oriented education and the specific demands that will follow on content. However, it should also be applicable to more teacher-centred education. In competence-oriented education, which includes a great deal of real-life professional assignments, the CAIO database should be the first place a student turns to in order to find high-quality information. Particularly the kind of information students are looking for if, during an assignment, they meet with problems for which they cannot provide an immediate answer. CAIO wants to offer them a solution. Of course, this will rarely be a perfect fit for the problem concerned, but rather a guideline for the student to help him or her come up with the right answer. To achieve this, it is essential that the CAIO database can easily be accessed and searched using different entries, so that the students will easily find the information they need. CAIO wants to be a facilitator in competence-oriented education. In fact, it will encourage 'just-in-time' learning. In case of more lecturer-centered education, CAIO allows a more flexible compilation of text and exercise books.

Teachers are able to compile their own modules based on learning objects that are included in CAIO. Such a module is called an educational component (EC), i.e. an independent unit of study, as viewed from the standpoint of the student, which can be studied (and tested, if necessary) individually [de Bruin et al, 2004]. An EC will take up approximately three or four hours of study – the equivalent of a half-day of study (or the amount of subject matter presented by an experienced lecturer during a college).
An EC does not just deal with content, but also with context. Moreover, an EC should be meaningful to the student. In this situation, CAIO will offer flexibility as well as other benefits over paper text and exercise books, particularly in the area of management and accessibility wherever and whenever the student wishes to study.

4. ARCHITECTURE

CAIO's architecture involves a number of smaller elements that are interconnected. First of all, it comprises two dimensions: content and context. The content dimension is taken up by the subjects, or ICT areas, for which CAIO should eventually provide information. For the time being, the ICT areas covered are databases, programming, computer technology & networking, and system development. The second dimension, that of context, allows for a number of different contextual approaches. In connection with the existing ICT education (as shown in the text box with course examples), the following contexts will be developed first: business, software engineering, communication & media and technological.
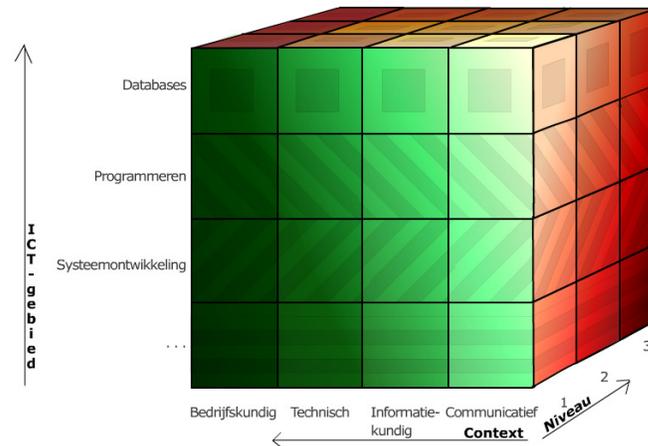
In short, the whole CAIO project will realise four content areas and four contexts, which are subsequently subdivided into educational components where each EC consists of an ICT-core, 'modifyers' for every context, examples from the ICT-industry and questions. Additionally, every lecturer may add own content to the EC. Finally, the EC's will be divided into learning objects (LO's). In this way a very flexible architecture is set up, in which every topic is accessible on different levels of difficulty.

Examples of ICT context:

- **Business** : Administrational ICT, Information Management, …
- **Software Engineering**: ICT, Information Engineering, ...
- **Communication and Media**: Communication Systems, Media Technology, Interactive Media, …
- **Technological**: Technical ICT, Computer Technology, …

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5. DEVELOPMENT APPROACH

The development of CAIO was started in January 2004. An crucial milestone to be taken by the development teams is to agree on the context-independent part of a subject, and with it, an agreement concerning context-related aspects. This requires further and deeper analysis of the subject from the different contexts, e.g. 'What is the common part? and 'What are the differences?'

During this process, a subject is divided into two types of learning objects: context-independent learning objects, the so-called CILOs, in which matters are discussed that are relevant to all contexts *(although these may be designated in a different way for the different target groups, as illustrated in the text box),* and context-related learning objects, or CRLOs, which deal with matters that only apply to a few or even just one of the contexts.

> The CILO for the above example of requirements may be described as follows:
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> The requirements are a [Bus: detailed description] [Tech: exact specification] of the functions [Tech: services and constraints] of the system.
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> With the CRLOs, examples of the different target groups may be described.

In addition to a consensus concerning context-independent components, decisions have to be made concerning the level on which these components are taught. After all, an software engineering or technological education will, in many cases, involve a more profound study of ICT aspects than an education in the area of business or communication. Therefore, these more in-depth approaches are context-related and will be dealt with in context-related learning objects.

The developers will have to concentrate their efforts primarily on content. The technical realisation will be handled explicitly within the project, ie. by the projectteam. To achieve this, an efficient content-development workflow will be set up, which can also be used in other knowledge domains and sectors. This is one of the so-called deliverables of the project. This way, the development process will result in a number of CILOs and CRLOs, which are labelled using metadata, enhancing accessibility and allowing easy search operations. As mentioned above, this database will, in competence-oriented education, primarily be searched by the student at learning-object level, while in more lecturer-oriented education, teachers are provided with the opportunity to use these learning objects to compose so-called educational components.

The CAIO project is carried out by the Hogeschool van Utrecht, in close collaboration with the Saxion Hogescholen, the Universiteit Twente, the Hogeschool van Rotterdam, and the Fontys Hogescholen. The development groups envisage future developments such as links to the knowledge communities of higher professional education in the area of ICT. For example, the 'programming' community may present itself as a review group for the CAIO development group on this subject. Apart from stimulating the contact between ICT lecturers in the Netherlands, this will reinforce the support for CAIO educational products.

Naturally, 'the proof of the pudding is in the eating'. But for the moment, we, as the project designers are very enthusiastic about this project. Especially since the project strives to:
- reach a general consensus concerning the ICT content in different types of education;
- embed ICT knowledge in the perspective of the future profession;
- fill an integral content database in which a vast amount of knowledge that becomes accessible through an electronic learning environment. This database may be used as learning material in different didactical settings, as well as reference material;
- unite the use and the management of content in a single model (teachers and students may have self-developed content included in the database); and
- set up a development workflow that may provide an example for similar projects.

We hope that our brief outline will make many people enthusiastic for our plans, which we believe will greatly enhance the transformation of ICT education in The Netherlands

6.   REFERENCES

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