Introduction
I should like to present a scenario describing how traditional practices in architecture are carried out in a digital environment. The scenario is a vision of the digital studio at the Aarhus School of Architecture and the idea is to underline that the radical shift is not the computer placed in front of you, but the fact that all co-operators assume that it is being used. I end the presentation by discussing five aspects of IT in the curriculum: tool, application, method, collaboration and communication.

Scenario: The digital studio
15 years after the opening of the first computer lab at the Aarhus School of Architecture we are about to close it. Meanwhile the lab has grown to several labs with nearly a hundred PCs, but the education has not developed to the same extent. IT-education is trapped in running efficient courses for all students, courses that obtain high scores at evaluations, but have little impact on projects. Therefore, the strategy has changed and the focus is now on the integration in the studio of digital work and electronic communication.

As a result of the IT strategy all staff members and students are presumed to have a PC which is connected to the internal net and to the Internet, and they are all given an e-mail account the day they start working or studying. The following scenario is based on these preconditions, and is put together of practices that are present at the school today found in various departments, but not formally set up in a general concept.

Electronic equipment in studio
Computer and other contemporary personal equipment, like mobile phone, digital camera and electronic network have entered the studio as a supplement to the personal working place. Students sketch and draw as usual, build models and use their computer for numerous activities, not just in their studies but also for daily activities. The working place is the desk in the studio, in workshops, seminar rooms or at home, and in all places the student can connect the laptop or gain access to personal folders from one of the shared PCs found in studios, seminar rooms, workshops, etc. Scanners and printers are at hand in the studios to support the integration of analog and digital work. Part of the equipment in the studio is also a LCD projector used for project presentation, crits and lectures.
Vision: The week in the studio
The local secretary organizes the timetable of the week, and sends it by e-mail to all students and professors in the unit. The secretary also organizes booking of rooms, schedule presentations, and communicates alterations. The students have individual timetables generated automatically by the Student Information System.

Students work in project teams. A new group is started by setting up a mail group, chat group and a shared web site, which are all useful elements in the day-to-day communication among the group members and between the group and the outside world. The students distribute project material between them and develop project ideas around the desk or by electronic communication. The web site is used for storing project documents and gives all members access to project material independent of time and location.

Before scheduled desk crits the students send e-mails with links to project material to their professors, and after meetings the student summarizes main discussion themes and recommendations. These are e-mailed to the professor together with the date of the next meeting and forthcoming themes of discussion.

Vision: A project in the studio
A new project is started by collection of information in various places. Photographs are shot and digitally stored. Maps of the location are collected from a local map database, building information, etc. is collected from external databases and the Internet is searched for information preparing the ground for starting the project.

Digital photos are printed and used as under-layer for sketching. Sketches are scanned, texts that elaborate the idea are added, and all material is gathered in a digital poster. Simple geometric models are made from the sketches and used for analyses of volumes, space, form, proportion, light and color. Images of the model are printed and serve as reference for discussion and under-
lay for further sketching. Scale models are built to examine the project. Web distributed databases are searched for information on building components, constructions, technical solutions and new materials, and architectural WebPages are studied for inspiration and references to the project in progress. Links and screen dumps are stored in the database of the project.

For mid-term crit illustrations are chosen from the database and added to the project Website accessible for professors, invited critics and fellow students. Posters are to be printed for the crit and are supplemented by screen presentations.

So what?
This description of studio work may seem rather ordinary, but the point is that it marks a shift in the discussion of computation in education. For the last decade the focus has been on computer courses and pedagogy. Faculty has been divided in groups, discussing when and how computer skills could be brought into the curriculum. Students have been attending IT courses for the last 10 to 15 years taught by professors with computer knowledge and skills, but often with little interest in architecture. After finishing the courses students go back to the studio and meet professors with little interest in or understanding of IT, but enthusiastic about architecture. In this fragmented universe the student has been the only one to bring the two worlds together.

Introducing the computer in the studio from day one and using it for communication, writing and other purposes familiar to the student have facilitated integration of computers in architectural projects. Offering network, printers, mail, Web and data servers has in a short time changed the attitude to computer work. The computer is at the same time exposed and has stepped into the background. “It no longer represents a threat to the IT-ignorant professor, because it is there, visible on the desk, and the results can be questioned and examined”.

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IT in architectural education

As early as in 1972 the perspective of introducing IT in the general educational system was discussed (Svejstrup, 1972). One approach was to reduce IT in education to a mere tool discipline. A more visionary approach referred to the information revolution and structured IT in education in five disciplines: tool, application, method, collaboration and communication, and concluded that there should be no boundaries between the disciplines, but that all elements should be included in problem solving. It is interesting that this argument was made years before we had experienced the Internet, and it seems to be even more appropriate today.

If it makes sense to compare professional practice and education we can expect that IT will cause changes in tools, methods, collaboration and communication. At the school of architecture the changes in collaboration and communication are significant. How IT affects methods is less understood.

We know the tools, and have seen how CAD and numerous applications dominate the arena. We can teach use of tools, but methods are a difficult task. Development of new methods is the key point where traditional professional qualifications meet the new media, and where the professor has a particular important assignment.

Five aspects of IT

Tools – which: IT are many tools created by software. Some tools are general, others are specific used by architects and related professions. Some tools are intuitive in their use, while others require special skills and knowledge. I relate to this wide definition of IT tools in the following discussion.

Application – where: In architectural education IT is used in several areas. Project work is clearly the most important field, but making of portfolio has an autonomous function and is highly dependent on skills in graphic and visual communication. Finally elements of planning and co-ordination are required. Project work is the most complex situation and brings many IT tools to work. Further discussion of IT in the curriculum is therefore concentrated on project work, being the field that sets the most comprehensive demands to application of IT.

Methods – how: The design process in architecture is usually described as a number of phases to go through several times before reaching a solution. There are different methods involved in the various phases and some IT based methods are listed here:

- Methods for researching the problem and data collection include searching the web, database management and mapping techniques.
- Qualitative and quantitative methods for analyzing a design or planning problem brings up GIS, and works of the Dutch architects MVRDV could serve as examples of GIS-like analyses in architecture.
- Design methods challenge the intuitive method that most architects are familiar with. Parametric construction, rule based form generators and games are all based in CAD-systems and open new perspectives of design thinking.
- Methods for graphical representation of projects are where IT is most present in students work.
- Methods for construction projects are where most research is done, but it is not considered an important topic in the general education.

IT-based methods are developed from the traditional practices when meeting the new media, and in general this does not take place in student’s work but is a result of experiments and research, while application of methods is supposed to be an important part of education. In a situation where the majority of faculty do not have neither skills nor understanding of the far reaching consequences of IT in architecture IT has been reduced to tools, and
application is mainly seen as graphical representation, while the problem of adequate methods has not been engaged.

Collaboration – who: seems to have profound consequences in organization of professional practices. In architecture and product design collaboration has been part of the agenda questioning the focus at the individual artistic development that has been characteristic of the education at the schools of architecture rooted in the Academy of fine arts tradition. Today’s agenda has changed to a search for partners with whom an innovative practice can grow (Cumulus 2002).

Communication – what: seems in a way to be the easiest to discuss. It is almost a paradox, because the implications of digital communication in society, and in doing nearly anything are so far-reaching. But digital communication is so obvious that it cannot be neglected. Digital visualization of projects has for many students of architecture been the first step into computation and has caused long discussions among students and professors about artistic visualization of poor architecture.

In the scenario I intend to say that even though faculty finds it difficult to respond to the potential represented by the new media, we can set up conditions that facilitate collaboration with students about integrating IT in the curriculum. The students know how to handle the tools while faculty represent the professional qualifications. The two parts meet in studio to discuss and investigate application of the digital tools. In this perspective it is understandable that the refurbishment of a digital infrastructure at the school of architecture followed by the presumption that everyone connected to it, was a strategic decision strong enough to make the institution move.

Application in a theoretical perspective

Digital media for spatial visualization is a subject that is continuously disputed. Faculty discuss with great enthusiasm whether students are supposed to learn freehand drawing before they learn digital modeling, and do not agree upon the necessity of learning how to construct a perspective before learning how to generate spatial images from digital geometric models.

The discussion is whether you can learn both forms of communication at the same time, and if not, which should be first, and I think there is a more profound question beneath. It is my theory that the underlying assumption is that you should learn freehand drawing to be architect. Digital communication is on the other hand considered a qualification to practice as architect. If the theory is correct it is not surprising that freehand drawing has priority. Education is about achieving basic knowledge and skills, and not least about developing a set of values, which distinguish the profession from other professions, and so saying also defines the profession for the architects.

Bourdieu’s concept of Habitus as set of capitals might be useful to clarify what the dispute is all about. Although sketching is a very small part of the work done by an architect, the ability of expressing ideas in freehand sketches is given a special meaning, and distinguishes architects as a group. If you are an architect the surroundings expect you to be able to sketch. In this sense freehand drawing becomes a part of the architect’s symbolic capital. It is something, which is unique for architects and is part of making them exactly architects. The technical abilities tied to perform the profession are secondary compared to this basic ability, which apart from freehand drawing may include the ability of spatial thinking and of searching solutions. As long as IT is considered to substitute freehand drawing it will therefore be disputed among real architects.