What is the Goal in Teaching Basic CAD?

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Abstract. In this paper we report on ongoing monitoring of the entering situation of students at our faculty in terms of their computer and CAD skills. By means of an online enquiry developed by Liverpool and Graz we also investigated the attitudes towards CAD by architects in practice. Based on these findings, we aim to identify what we should teach our students in terms of CAD skills.

Keywords. Basic skills teaching; post graduation demands; education; situation in practice.

INTRODUCTION

CAD education at the university has two main purposes. The first is straightforward skills teaching to make students competent users of CAD software which they can use later in practice, and the second is to give them an informed and critical attitude to design with computers. Therefore there is always a balance to strike between practice oriented CAD teaching and more theory oriented CAD teaching. The study of architecture takes at least five years. The computer technology and software have a very fast development - it sometimes makes the student (and the teacher) during the studies at the university feel as a passenger on a fast train. The student expects from the university, that (s)he will get the contemporary skills for the job after graduation. Nevertheless, practice is that they start with the new technology at the beginning of his studies at the university, and after graduation the newest technology is different. Without a critical attitude quick adaptation to new technologies is much harder.

In the Czech Republic there is a strong demand for students to be useful in design studios right after graduation. The current situation, how the design offices use CAD software, is quite specific. There are very big differences in level of using computers skills. The inquiry of which we present the results here, shows that the majority of design offices use CAD as basic drawing board (65%), and that modern technologies – BIM, rapid prototyping, parametric design, collaborative design, advanced CAAD, and multimedia presentation all together make up 35% within the offices. There is no denying that training students for this situation is not productive let alone for when they graduate five years later.

In this paper we present developments in the starting situation of students when they begin their studies (first part). Following, we report from findings of an enquiry about CAD in practice (second part). This inquiry is based on the online survey created by Knight and Dokonal (see Dokonal and Knight, 2007, and Knight and Dokonal, 2009), held earlier in the UK and Austria.
ONGOING ENQUIRY: STARTING SITUATION IN EDUCATION
Since 2006 we hold an inquiry among students to take stock of their computer use just before starting their studies. From this inquiry we can see that each year there is an increase in terms of computer use and available skills. Figure 1 shows the proportion of students who have their own computer. As can be seen, 97% of the students have their own computer and can use it as basic equipment in their studies in the first year. For the rest of the students, or for the use of specialized software, our faculty offers workstations in three computer labs - these labs are also used for teaching and instruction.

Figure 2 shows that the majority of students have a notebook rather than a desktop computer. Even though there is a price difference students seem to prefer the mobility that a notebook offers. Indeed, we can observe that the notebook is a constant item in the student’s “luggage,” almost as ubiquitous as keys, mobile phone, wallet, and handkerchief. For us this is significant because it indicates an attitude in which the computer is no longer a ‘special thing’ but really an everyday application. The same can be inferred from Figure 3 as well, where we asked for computer activity in basic school and high school. Again a steady increase can be observed (35% increase).

It is clear that the new generation lives with computers (in the rather exceptional year 2008 probably a very interesting game for teenagers was released) as we see a steep incline of activity in basic school. Finally we also see a correspondence with the following Figure 4, which indicates the proportion of students who have zero experience of CAD. There the drop is also steady although less dramatic (from 72% in 2006/07 to 68% in 2010/11).

Figure 1 (right)
Ownership of own computer.

Figure 2 (left)
Breakdown of ownership to type of computer.

Figure 3 (right)
Start of computer exploitation.

Figure 4 (left)
Zero experience of CAD.
In the first year of their studies, the students have an obligatory program of two semesters where they study AutoCAD and basic skills in 3D modeling as SketchUp and rendering in 3D Studio Max Design. There are no optional courses in the first year, and because of the large number of students, they are organized in classes simply based on their name. Only in the second year and later can the students choose more specific software in their studies. We organize many meetings and lectures about possible directions in CAAD, and offer a wide range of courses in various programs. Figure 5 shows the students’ preference at the end of the first year, which program they would like to continue with. At the conference in Ljubljana we will present the latest data from this study year.

SECOND INQUIRY: ATTITUDES TOWARDS CAD IN PRACTICE

In order to take stock of the current attitude in practice towards CAD, we have applied the online enquiry developed earlier by Dokonal and Knight and addressed about 1000 architects through the memberships of Czech Chambers of Architects. We only asked architects who have their own design office. Of specific interest to us in this inquiry was the response to the questions alongside with the age of the respondent. From studying these reactions we hope to predict or anticipate what the contemporary student of the first year may expect after graduation. We received 106 completed and valid reactions.

As can be seen from Figure 6, there is only a small group of young respondents that have their own design office. The other age groups are well balanced - there is no dominant group in the respondents.

We use CAD as an electronic drawing board

For the majority of architect’s offices in the Czech Republic it is the case that CAD is used simply as an electronic version of the drawing board. Over the age ranges agreement with this statement is 84% (age 20-29), 58% (age 30-39), 54% (age 40-49), and
63% (age 50-). It is interesting to notice that the oldest age group is active with the use of CAD.

**CAD is used as a tool alongside “traditional” methods of sketching and modeling**

Design offices use a mix of media in the design process - not only CAD but also sketching and scale models. Over the age ranges agreement with this statement is 83% (age 20-29), 42% (age 30-39), 61% (age 40-49), and 42% (age 50-).

As a practice we are open to new ideas and technologies to use in the design process

With this question we aimed to investigate the willingness to change or adapt the current design process in the design offices. We have to note that the willingness does not indicate concrete change in an office. Nevertheless, as can be seen from Figure 9 there is strong agreement with the statement: 83% (age 20-29), 73% (age 30-39), 84% (age 40-49), and 73% (age 50-). It seems in all cases that the Czech design offices are indeed open for change, and that they do not intend to hold on to established practice just like that.

**How many hours a week do you spend using a CAD package?**

As can be seen from Figure 10, Czech architects spend a lot of time using a CAD package: all day (50 hours or more) has agreement with 14% (age 20-29), 17% (age 30-39), 0% (age 40-49), and 24% (age 50-), and a substantial amount (more than half a day per day) for the age groups: 72% (age 20-29), 66% (age 30-39), 52% (age 40-49), and 42% (age 50-). The amount seems to be out of proportion with the reaction to “CAD is used as a tool alongside ‘traditional’ methods of sketching and modeling” - perhaps there is a slight inconsistency here. Nevertheless it raises the question whether practice could (or should) become more effective. 49 Hours means that it is 9 hours per working day. Due to the economic crisis many small architectural office in Czech Republic had to close. Perhaps here lies a challenge for our students, to make work more effective.

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*Figure 8 (left)*

CAD is used as a tool alongside “traditional” methods of sketching and modeling.

*Figure 9 (left and right)*

As a practice we are open to new ideas and technologies to use in the design process.
**Is training available to you?**
We see that the majority of architects learn to work with CAD software in an informal way (meaning no official training or following paid courses). In our view this means that most likely practice works “demand-driven” - an architect gets confronted with a (new) software and aims to learn as (s)he goes along. Problems are solved ad-hoc, or consulted with colleagues (in house: 9%). We feel that in this way a lot of potential of CAD simply is not used because the professionals are not aware of the latest developments, advances in research, or application in practice. It would be advisable to investigate in more detail how practice actually deals with the informal training.

**Which system is preferred by students 2006/10?**
Additionally to the attitudes towards CAD questionnaire, we also monitor the students’ preferred system throughout the years. The diagram in Figure 12 leaves out AutoCAD because they get it in the first year of study. There is a fairly strong focus on visualization (3DStudio Max Design), followed by ArchiCAD and Rhinoceros. Parametric design is virtually unknown (and therefore not desired) by the students.

**Which CAD system is predominantly used in the practice?**
In Czech practice AutoCAD is the clear market leader, with an additional strong presence by ArchiCAD. SketchUp has become increasingly popular as it obviously fills the gap between concept generation and more detailed production work in later stages.

**DISCUSSION**
From the results gained from the two surveys (starting situation in education and attitudes towards CAD) we can see a fairly conservative situation in practice which is receiving an increasing inflow of young architects that are more and more computer oriented. A lot of time is spent in practice with CAD software, but perhaps the effectiveness could be increased. Practice seems to be unwilling (or unable to finance) life-long learning. This means that
innovations are only slowly entering the design process (even though architects are willing to consider them). Here we feel there is an important role for the young graduates that will enter practice. We hypothesize that if people will structurally spend more time keeping up to date with current developments, that it will be beneficial to current practice. In our research and education work this is indeed what we aim to achieve (Matějovská and Achten, 2007, 2008).

The inquiry has shown that the main stream in Czech design studios is AutoCAD and electronic drawing board. The fast improvement of skills in CAD was in 90’ies of last century after the Velvet revolution following the huge boom of computer ownership and use, as well as using the new technologies in the design offices. After that we can see a steady increase in the use of CAD in practice, and a faster increase in the generations that enter the university. The goal of teaching CAD in our local situation therefore is on the one hand practice oriented (students have to be able to function in practice immediately after graduation), but we also aim to give them a more critical approach and an attitude towards life-long learning.

ACKNOWLEDGEMENTS

The authors would like to thank Mike Knight of Liverpool University and Wolfgang Dokonal of Graz University for the cooperation and use of the online enquiry system, which was used for a similar investigation in the UK and Austria. Also, we would like to thank the respondents to the enquiry that was held in Czech Republic.

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