Assessing Computer–Aided Design Skills

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INTRODUCTION

Computer-aided design (CAD) is the use of computer technology to aid design. It is often referred to the use of computer software to draw two- or three-dimensional drawings or models. It improves the quality of drawings and models, makes the communication in design processes more effective, and increase the productivity of the entire process. Most schools and universities would offer CAD courses for students in design or engineering disciplines and subjects.

Assessing students' knowledge and skills of using CAD computer software is thus inevitable. However, the assessment of CAD is often problematic. Computers are not always available because of the facilities arrangement and administrative issues in schools or universities. It is ineffective and difficult to arrange computers for a large group of students in an examination. The number of CAD software licenses may also be limited, and students are unable to use the software at the same time. Grouping students in different time slots to take the examination may be an eclectic way to solve the issue; however, the tutor or the lecturer would have to develop several sets of questions for the students. The examination in this case also loses its authenticity, as students are able to guess the questions based on the comments of students who took the exam in an earlier time slot. In addition, using particular software in CAD examination can only assess students' familiarity towards the software but not the general knowledge of CAD.

The issues of computer facilities and software license and the limitations of computer-based examination made CAD assessment difficult. Taking references from some computer programming subjects, it is believed that using paper-and-pencil method is a choice to solve this problem. However, the scope of paper-and-pencil questions is limited, as the questions appeared in the examination can only comprise the most common functions in various CAD software.

This chapter discusses the issue through examining and reviewing existing CAD examination questions in Hong Kong. Based on the review, limitations of the current assessment are highlighted. It is argued that the existing method is inconsistent with the problem solving nature of the software and is unable to assess students with high ability and advanced drawing skills. Recommendation and improvement directions are suggested in the chapter to optimize the quality of assessment. Other subjects which also involve assessment of computer skills and design may also benefit from the recommendations.

BACKGROUND

The term computer-aided design appeared in the late 1960s (Abbas, 1976). Since then, many different disciplines of engineering applied CAD, and the industries also needed staff possessing this kind of skills to make their designs and products to catch up with the trend. Educational and academic institutes had also started to introduce CAD courses to their students. Some institutes had offered CAD course as an elective subject, or combined the knowledge of CAD in other

existing subjects related to engineering design. Specialized and short courses of CAD were very popular in various engineering disciplines and increasingly in design disciplines. As students in design disciplines had not got any technical training, they encountered difficulties in using the computer software, and sometimes they could not get what they wanted through CAD. Apparently, this discrepancy is getting smaller over the years, and now students without technical background are able to use computer software to assist design effortlessly. This is primary due to the popularization of computer technology in the last few decades.

Nowadays, CAD has been extending its application in other disciplines such as mathematics, music and geography. Various kinds of CAD software have been developed to attract the attention of the industries and the academia. The software may possess similar function but different layouts and orientations to provide choices for different needs of the customers. However, due to limitation in resource and time in universities, tutors and lecturers can only teach the selected software based on the actual needs. Students have to explore other software by themselves. Some secondary school teachers have also noticed the needs and started to contact the software companies to buy school license for the computers in the computer laboratories. They have started to rearrange the curriculum and put CAD knowledge and abilities as one of the learning outcomes.

Teaching CAD Software

One of the most effective ways of teaching CAD is to demonstrate the drawing procedures of a particular drawing or model step by step. Teacher can first show the finished drawings and ask students to follow the teacher while the teacher draws on the computer. Teacher will be able to help students and solve students' problems while teaching the steps. At the end of the lesson, all students will be able to finish the same drawings. Through the drawing process, students can learn

different functions of the CAD software. Teacher can also allow students to decide how they use a particular function in the drawings, e.g., whether the function should be applied on this line or the other line. In this way, different students can have different drawings in the end of the lessons. However, this is only applicable to students with higher learning ability. Sometimes the CAD skills learnt are transferable, and they can be applied in using other CAD software. There are many other methods to teach CAD skills. For example, teachers can use problem-based projects to facilitate students learning CAD software.

Learning CAD Software

Prior to learning CAD software, students need to possess basic computer knowledge. They should be very familiar with the operation system of their computer, e.g., Windows and Macintosh, before they can create and generate drawings and models in their mind through the CAD software. They also need to learn the basic shapes that comprise a drawing and analyze the drawings they wanted to create. They need to possess the cognitive ability to manipulate the drawings in the mind before working on the computer. The prior knowledge is essential to facilitate students to learn the functions of the CAD software. Once students are familiar to the functions and the working procedures of the software, they will be able to draw any drawings or make any models they need for their designs. Students will be able to produce neat and clear drawings and present their design ideas more effectively. Some students can make use of the features of the CAD software to design while drawing. The convenience and the effectiveness of CAD software also facilitate the idea generation in design processes. Chester (2007) had made a comprehensive discussion about CAD expertise. He identified two kinds of knowledge: command and strategic knowledge. Command knowledge is the knowledge of the commands and the drawing procedures. Strategic knowledge is the alternate method of finishing a specific drawing or task.

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