



Three in a row with CAD



Course summary

In the course, students in primary school learn the basics of the cloud-based CAD program Onshape. When they can, they will design a game plan and a play for the game Three in a row, and make dimensioned drawings. Finally, a game plan and pieces are printed with 3D printers. The drawings will later be used when the students make the game in metal in the school's workshop. Teaching and supervision is done by students in the upper secondary school's Technology Program.

Course facts in brief

Time: 3 x 90 minutes

Number of students: 24

Number of supervisors: 10

Number of groups: 5

Age of students: 10+

Prerequisites for students: None

Prerequisites for supervisors: CAD program Onshape, drawing technique, printing on 3D printers.

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Introduction

Background

Society's and business's need for people with technical knowledge is increasing, at the same time as the interest in applying for technical education is decreasing or at least not increasing to a sufficient extent. Something should therefore be done so that more young people will choose technical both vocational and pre-school education in upper secondary school.

Purpose

The purpose of these lessons is to allow younger students in primary school to come into contact with interesting technology they have not worked with before, while they are supervised by older students who go to high school technical education. The older students become a bit of role models and can then more easily with their youthful enthusiasm transfer their interest in and attitude to technology to the younger students.

Method

The younger students are given the task of solving a technical problem, for example to program a Lego robot, construct a game in CAD and print it on a 3D printer or to mill the game in the workshop together with high school students based on the drawing they created in CAD. To succeed in this, the older students must teach and supervise the younger students in the current technology. The contact between the younger and older students around concrete tasks can create conditions for both arousing and deepening interest in technology.

Three in a row with CAD

The game Three in a row contains a game plan and nine pieces of two ferries which, with the supervision of older students (hereinafter referred to as supervisors), are a relatively simple task to design in CAD for middle school students. It is also possible to enter the students' names on the game board and then it often becomes even more fun to print the game on the 3D printer. The task also includes making a drawing in the CAD program, which will later be used when the students are in the workshop and at least may be present when the older students mill out and possibly turn the game pieces.



Preparations in high school

The high school students have taken a CAD course of 50 hours and learned to use the free cloud-based CAD program Onshape. Before the tutorial starts, the high school students have designed the playing field and pieces in CAD, and made a dimensional drawing in the CAD program. The dimensions of the playing field and the pieces come from an older drawing (see the appendix). Prior to the younger students' visits to the upper secondary school, the older drawings have been copied up on the front and back and laid out at each computer, as well as a paper with the group division (see below).

Preparations in primary school

Since the high school class consists of eleven students and we expect two high school students to supervise each group with younger students, the teacher in primary school has been asked to divide the students into five groups designated A-E so that each student knows which group it belongs to. The teacher in the compulsory school then sends the group division to the teacher in the upper secondary school, who divides the supervisors in the groups (see the appendix). We have chosen two supervisors per group to have an intact group division even if one student is away. However, it also works with one supervisor per group.

Implementation

When the younger students arrive at the high school entrance together with their teacher, they are met by all the supervisors and their teachers. When they arrive at the classroom, the teacher welcomes the visitors and tells them quite briefly something about CAD and what the students should do. Then the teacher presents the supervisors and which group they should supervise. The supervisors stand up as the presentation takes place at their computers and the younger students are encouraged to go to their tutor. After that, the

supervisors take over the teaching of their groups. The goal is for the younger students to work in pairs at the computers. However, it is important that the students' abilities are at approximately the same level in the group so that no one takes over the computer work with CAD. An alternative is for each student to work at their own computer, which, however, requires more from the supervisors.

The ideal is if the younger students can come to high school on three occasions, where each opportunity lasts 90 minutes.

First time

The supervisors go through basic CAD concepts here, showing how sketches are made and dimensioned and how they are extruded into three dimensions.

Students should learn about squares and circles, as well as how holes are made. After that, the students have to solve a number of basic exercises for the rest of the time at the first opportunity.

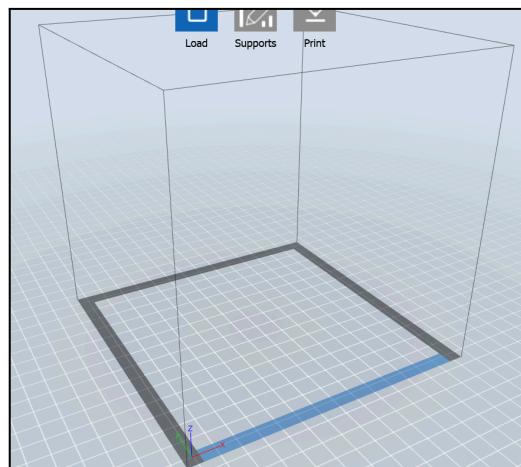


Second time

When the students have solved all the specified exercises, they open a new document, Workspace, in Onshape and start designing the game board as a part called the Game Plan, and then the game piece as a new party with the name Play. Here it is important that the supervisors explain the difference between workspace and part.

Third opportunity

When the playing field and play are ready, the tutor shows how a drawing is made. The student then creates a new drawing with the name Spelplan_ritning and then Pjäs_ritning, which are dimensioned. When the drawings are ready and named with the students' names, they are converted to PDF form and uploaded to the task in the Google Classroom. The intention is that the drawing will be used when the playing field and play are made of metal in the school's workshop together with other supervisors at a later time. Thereafter, STL files are saved by the parties under the names Spelplan.STL and Pjas.STL. These files are uploaded to the Flashprint

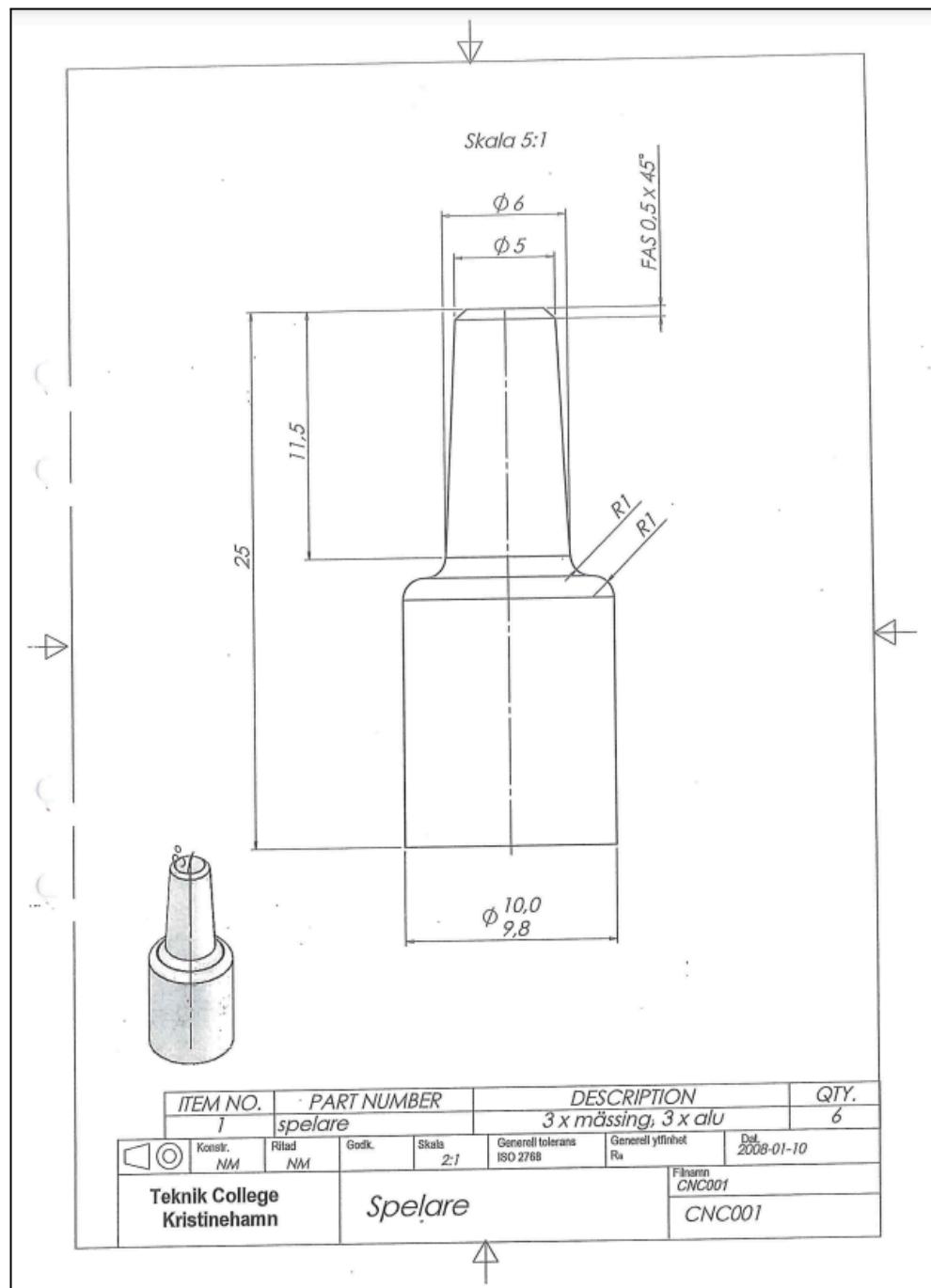


program, which creates a .gx file that the 3D-printer is fed with. Since all students who do not want to have time to print at this time, the supervisors do this afterwards and the finished games with pieces are handed over to the students at a later time. The students would like to have their own copy. Therefore, it is important that they get it so that they get a positive memory of the exercises and thus perhaps also of technology.

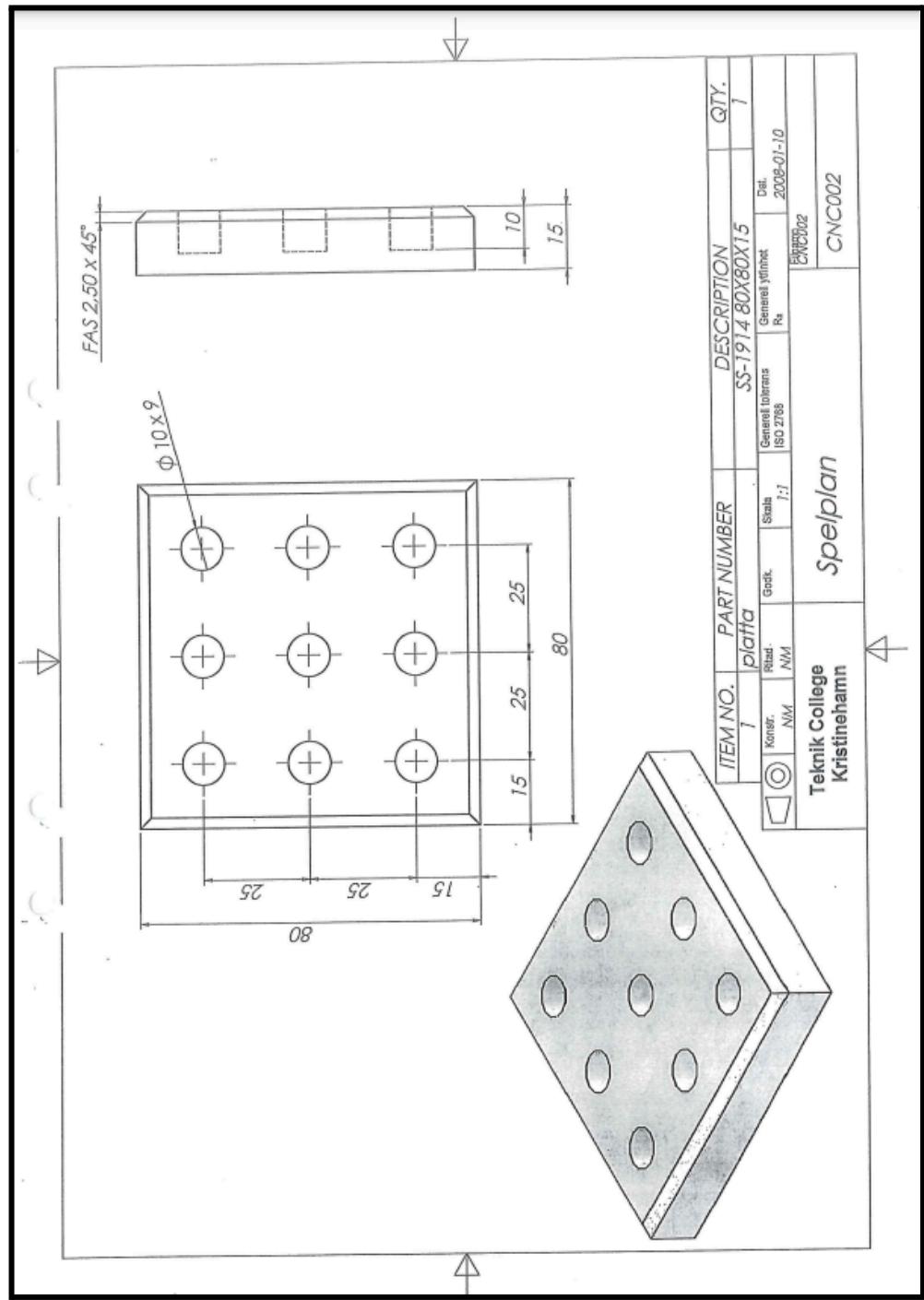
Evaluation

When the students have completed the three opportunities at the upper secondary school, an evaluation is made of how they experienced the CAD course, and of how their teachers felt that the course worked for the students. The purpose is to get tips on how we can improve future courses. Supervisors should also be allowed to evaluate their participation. The evaluation is done with the help of the tool Google Form. Here is an example of the [students'](#) and [teachers'](#) evaluation.

Appendix



Drawing the students are given to measure their drawing.



Drawing the students are given to measure their drawing.

CAD-kurs för årskurs 5 på Brogårdsgymnasiet 11 och 25 maj 2022

Klass TE2 möter er i rasthallen på Brogårdsgymnasiet kl 08:30, vi går tillsammans till sal E8 och håller sedan på tills kl 10:00.

Handledare i klass TE2

Grupp A: Filip, Ketevani

Grupp B: Leo, Kasper, Josef

Grupp C: Christo, Viktor

Grupp D: Bahwar, Kyle

Grupp E: Felix, Meia

Grupperindelning



Distribution of supervisors (Handledare in Swedish) on the groups they are to supervise.