

The art of security – Teacher guide

Background to the task

This task is designed for a half day mathematics modeling event for teams of students in lower secondary education. No advanced mathematics is required. The task offers possibilities for examination, analysis, reasoning, calculation and design. It is sufficiently 'authentic', asking for a 'real' product, without being too complex.

The task has a somewhat closed start, a middle part that is mainly aimed at the evaluating and a well-reasoned adjustment of an existing situation, and finally an open design task, in which there is also room for reflection. In the last part the students can take up a role of a professional. Simultaneously, the mathematics involved (geometry, lines of sight, scale) is sufficiently recognizable.

The task is set up as such that all teams can start, but that there are also options for differentiation. There will especially be differences in the results of the final task in creativity, depth and the use of mathematics.

Practical instructions

Your students will be working on a large open problem all day (ca. 8:30-14:00) or during a sequence of lessons. This is probably new to them, and perhaps even to you, therefore we will give you the following practical tips and tools. The students' task is also preceded by a checklist with some points of interest.

- Set up teams (of three or four students) beforehand; experience has shown that teams that represent a diversity of qualities -e.g. in the field of: maths, writing, cooperation, management, monitoring the mood - usually deliver good work;
- make sure you have a sufficient number of copies of the plans in the appendix, and a sufficient numbers of computers/laptops (at least one per team);
- make it an extraordinarily special activity;
- you could give a short central introduction at the beginning of the day on how to work, the breaks, the moment to hand everything in and then hand out the task;
- you could start on the task plenary by e.g. going over the points of attention together or by carrying out the suggested activity in the appendix;
- stimulate the teams at regular intervals by checking on them and asking them what their progress is;
- it might be necessary to point out to the teams that it is time to start on the report.

The task

This task does not have an assessment model. A diversity of methods can be used. We will provide three short descriptions, followed by a list of general points of interest for the assessment.

1. Take a look at the task with a colleague beforehand and set up an assessment model; define categories in which you assess the students and assign points to each category.
2. A bit more work, but comparable to the aforementioned, is designing a rubric; then you do not assign points per section, but you give a qualification to certain characteristics.
3. The simplest way is probably to globally go over the results first and to categorize them then in three or four categories (good, sufficient/moderate, insufficient); subsequently, you amplify your criteria and refine the format, so you can reach a final sequence; when you do not have too many papers and work together with a colleague, you could each make this format and compare them.

Points of attention in assessing papers

The aim of assessment is reaching a classification in quality. This is best accomplished when certain criteria are formulated. The criteria for the assessment are divided in two categories.

Firstly, general criteria for the report in a paper with such an task, e.g.

- overall impression after glancing through, e.g.: layout, structure, ...;
- readability and spelling;
- professional use of language, e.g. informative instead of narrative;
- supported by diagrams, graphs, drawings, etc.;
- presence of useful remarks exceeding the direct solution of the problem.

Secondly, the criteria resulting from the content of the task, e.g.

- the strategy is clearly documented;
- the assumptions are clearly stated;
- correct calculations;
- an efficient solution, based on convincing arguments.

Depending on the personal preferences and/or consultation with colleagues criteria can be added or omitted and valuation factors can be used.

Good luck and enjoy the task!

Appendix: Activity introducing the task

Ask the teams how many students are needed to safeguard a part of a floor of the school (part of the hallway and classrooms). Let students design a draft first. Then ask a pupil to stand against a wall with his/her back and rotate the head in order to define the area (scope) that can be covered. Make sure that there are also walls or doors in the way. Let the students define the visible and invisible areas on their draft.

Like this they can shortly experience what the problem is and what the bird view of the rotating cameras comprises of.

This may take up to about twenty minutes. After that each team will start working on the task.