

## Students' planetarium

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Students' planetarium has been built in three weeks with commonly accessible, low-priced constructional materials. Choices of building materials were strictly connected with the mobility, the possibility of a quick assembly (2 hours) and disassembly (30 minutes), the availability of materials in every place in the world. The design of the planetarium is completely authorial.

The process of the construction of a mobile planetarium has significantly influenced students' skills in astronomy (they had to improve their astronomical knowledge and to learn how to use the astronomical software), in mathematics (to calculate the needed materials and to design and build a spatial form) and in physics (optics- the possibility of projection with a convex mirror, thermodynamics- heat exchange, cooler construction, strength of materials).

During the construction students had also to calculate all parameters of the planetarium construction, to choose materials of appropriate technical parameters, to build a planetarium durable framework, to elaborate the methods of projections and sounding, to learn how to use dome projection software and finally taking into consideration the spectators' comfort. They also had to design the system of air conditioning and cooling. The project is entirely consistent with the STEM and STEAM method. The artistic factor of students' work was revealed during the visualization of a planetarium projections and its decoration.

The students' mobile planetarium was presented at the international conference Revolve IPC in Centrum Nauki Kopernik in Warsaw in June 2016 and at the Polish national conference Science on Stage in September 2016 in Poznań. The idea of the project was also presented at the fabLEARN conference at Stanford University in the USA in October 2016. Since the beginning the planetarium was assembled at school eight times. The final product of students' work is a functional planetarium and its construction manual available in two versions: Polish and English. The total cost of the construction of students' mobile planetarium was 300\$.