

To materialise ideas. Differential, electrical and gearbox models dominated the unique 3D printing competition for high school students

A functional demonstration of a differential lock was unbeatable in the competition for the best 3D-printed educational model in the field of technology or science. The competition is intended for high school students and is organised by the Faculty of Mechanical Engineering of TUL (FME TUL). The authors of the electrical book took second place, and the creators of the model of a single-stage gearbox took third place. However, no high school student who participated in this year's second competition edition left empty-handed.

This year (2023), 20 teams entered the competition. In the finals, 14 models competed for the jury's favour, and 13 high school teams from all over the country presented their creations in person in front of the judges. The jury, composed of FME TUL experts, looked primarily at the design of the model, its quality, functionality, difficulty, use in teaching and, last but not least, the team's presentation skills. The competition, unique in its complexity, focus and nationwide scope, was organised by FME TUL for the second time.

"Compared to the first year, this year's models were, in many cases, at a significantly higher level. Some of them were really detailed both technically and in terms of their use in teaching. The teams also often tried to combine their knowledge in the field of engineering interdisciplinarily and IT technology, which raised the solution and complexity of the models to a higher level," evaluated this year's FME TUL Vice Dean [Luboš Běhálék](#) and added:

"Significant is the sponsor of each team, the teacher, who is the driving force in successful teams, who motivates and coordinates the students. The positive relationship between students and teachers is the basis for success, as we have seen this year."

The essence of the competition is for high school students to invent and, using 3D printing technologies, make models of technical devices that illuminate the principle of their operation. The models will also make the teaching of technology in schools more attractive. The competition teaches high school students to work in teams, take responsibility for completing the project on time and in the best possible way, defend it, and present it to an audience. They can compare their skills and abilities by bringing students and teachers from different schools together in the finals.

First place and a financial reward of 25 thousand. The students of SPŠ and VOŠ Liberec won with a functional model of a differential lock. The model illustrates the function with and without the lock engaged and shows how the torque distribution to the wheels works. *"Even with drawing, we spent about five days on the model. We learned a lot about teamwork. I got to experience what it takes to lead a team and how to solve problems that arise in a short time,"* said Matěj Hájek, the winning team leader. *"I really enjoy 3D printing and it has a great future. Its use is already expanding. It's not just plastic anymore; it's also concrete, metal or glass."*

Second place with a financial reward of 15 thousand. The students of the Gymnasium Dačice defended their electrical equipment designed for teaching electricity and magnetism in physics. *"This year, we focused even more on making the aid really useful in teaching and helping students. The kit can be used throughout the entire study period. From primary school, when students learn how to wire a light bulb, to senior year, when wiring complex circuits. We will multiply the kit to make it a set for everyone,"* said Matěj Kopeček on behalf of the silver team.

Students of SPŠ Ústí nad Labem took third place with a model of a single-stage gearbox with spur wheels and direct gearing. In addition to the financial prize of 10 thousand, they also received a special award from Prusa Research – a 3D printer worth 25 thousand CZK. *"We had the task of translating what we drew in our design classes into the real world. Probably the hardest part was creating the bearings and threads. I improved a lot in printing and learned how to solve mistakes,"* said Filip Ciganik on behalf of the team.

In addition to the Ministry of Education, Youth and Sports, this year's event was supported by 18 industrial partners who donated 50 thousand CZK in financial rewards. Even the teams that did not finish on the podium could take filaments for their school printers.

This year, for the first time, the competitors had the opportunity to compete for a special prize of Prusa Research a.s., which was the MK3S+ 3D printer from the limited "golden edition". *"The only condition was to upload the model to the Printables.com database. Thanks to this, other schools can also print and use the model in teaching. We want to develop this cooperation with Prusa Research in the future,"* said jury member [Jiří Šafka](#) from the Prototype Technology Laboratory of the Research Institute for Nanomaterials, Advanced Technologies and Innovations of TUL and [the Department of Manufacturing Systems and Automation of FME TUL](#).

The Technical University of Liberec is the leader of the National Centre for Industrial 3D Printing (Jiří Šafka is its head, editor's note) and promotes and develops this technology through competitions. At the same time, it playfully promotes technical and science education and the university as an inspiring, friendly and creative environment. TUL is then the first choice for high school students when filling out their studies applications. After all, this year's jury also included Matěj Preisler, a first-year student of the Bachelor's degree programme in Mechanical Engineering, who participated in last year's competition as a member of the SPŠ and VOŠ Liberec team.

[Photos](#)