

Fostering creativity, developing imagination, and creating something new

3D printers in schools make both teachers and pupils want to experiment with the technology of the future. These are the first steps for the Lichtenfels Center of Next Generation Digital Technologies (*Forschungs- und Anwendungszentrum für digitale Zukunftstechnologien, FADZ*), which is being developed in Lichtenfels in cooperation with the Coburg University of Applied Sciences.

"It makes a huge difference whether a design exists only on paper, is created in a CAD programme – or whether the pupils can ultimately touch their own work in three-dimensional print," says Sebastian Faber, subject teacher at the Herzog-Otto-Mittelschule in Lichtenfels. A 3D printer has been included in classes for five years now. A stereo loudspeaker for mobile phones, which used to be cut from plywood, can now be designed on the computer and printed. At the same time, the students design a bracket for the layout, which is filed, drilled, and milled from an aluminium block, in the CAD programme and print this in plastic using additive technology. In one case, the bracket is machined from a large workpiece, in another case, it is constructed point by point.

"I use the 3D printer to print cubes and cuboids for my fifth grades or cylinders for my eighth grades," says Johannes Mann, mathematics and physics teacher at the Meranier-Gymnasium in Lichtenfels. It is much easier to understand volumes or pi when you can actually touch something. In his project seminar, pupils design brackets for sensors themselves. In the end, a Range Rover the size of two shoe boxes shall be able to drive autonomously, a joint project with a company from Kronach. Where do you attach the bracket? How does the distance sensor hold securely and in the right place? How shall the bracket be designed so that it leaves enough room for the connecting cables? It takes everyone three or four attempts until everything fits. "We can create complicated shapes that have a real benefit using simple software," Mr Mann summarises the fascination of three-dimensional printing.

The Meranier-Gymnasium secondary school has three such printers. They were donated by Kerstin and Frank Carsten Herzog. "This already brings a piece of FADZ to life," Frank

Carsten Herzog is pleased to say. What is important to him is enthusiasm, the catching fire as soon as you start to explore the possibilities of 3D printing.

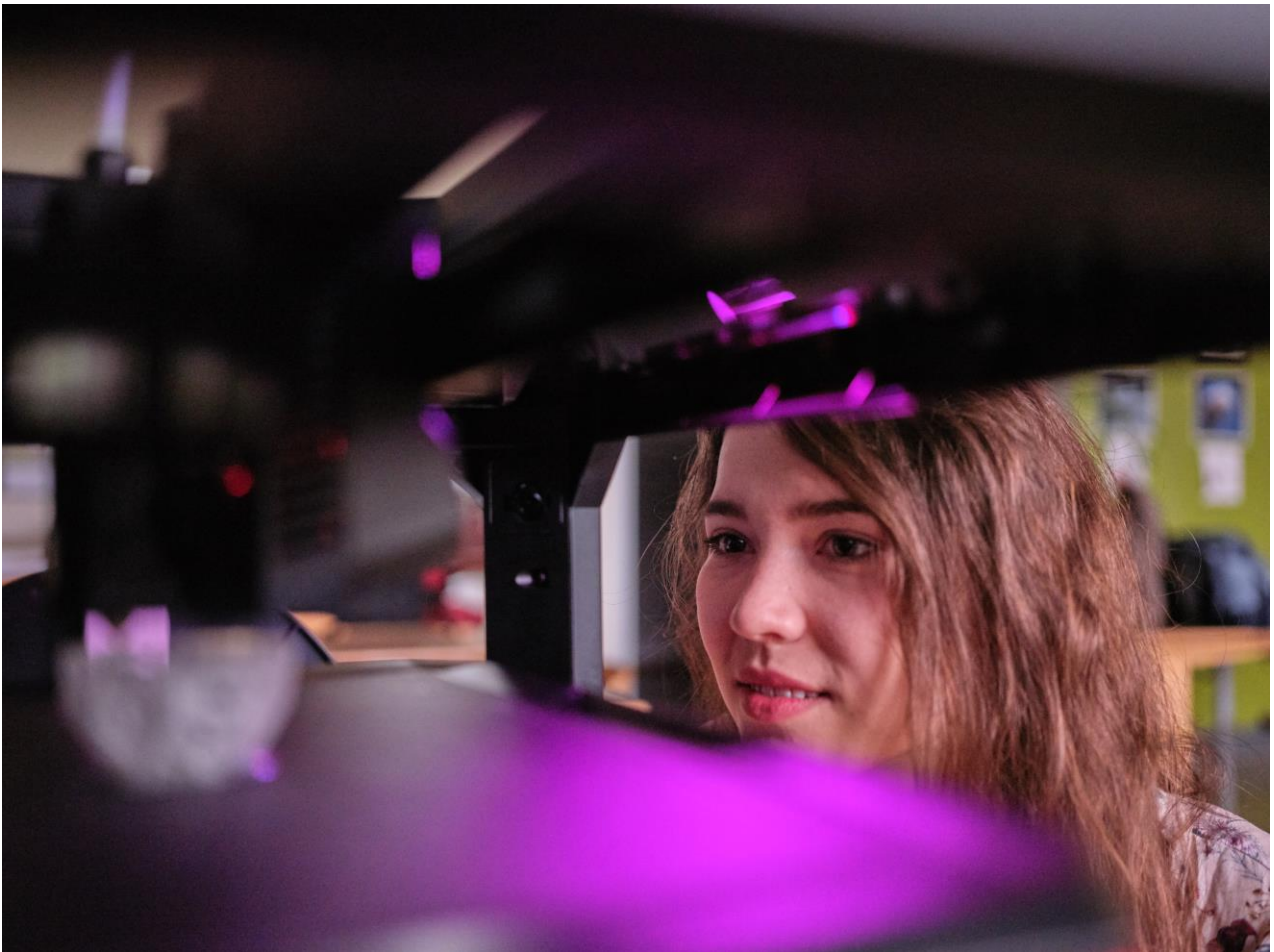
In the Creapolis makerspace in Coburg, students and teachers alike were able to learn the first steps. In addition to 3D printers, this open workshop also provides laser cutters and wire bending machines. "Students supervised us there in small groups of four people maximum. They were unbelievably committed, knew their stuff, and always created practical connections," says Matthias Bergmann, subject supervisor. "3D printing can be included wonderfully in German secondary schools – in the vocational preparation technical branch, it is incredibly valuable for motivation, creativity, and spatial awareness," says Mr Faber. "The students also take the technology with them to their training companies. The trade will benefit from this to a great extent." In addition to the printers, Mr Faber would like to see more machining options such as laser cutters in a makerspace at each school. "This would be the ideal bridge between secondary schools and FADZ," says the subject teacher.

"This is exactly the kind of experience we want to gain," says Frank Carsten Herzog. Like a jigsaw puzzle, FADZ shall be set up and come to life step by step. Curiosity, a spirit of research, and practical relevance will be brought together at the Kirschbaumühle premises in the heart of Lichtenfels. "We want the enormous range of possibilities that we are already seeing with the projects at the Meranier-Gymnasium and the Herzog-Otto-Mittelschule to be reflected in FADZ. We want to locate the master's programme in additive manufacturing of the Coburg University of Applied Sciences here, be a point of contact for small and large companies – and be open to all schools," says Mr Herzog. Between laboratory, workshop, and repair café, everyone should be able to work on and develop small and large ideas. "It should become a matter of course and part of everyday life that everyone can think of and also use these possibilities," Mr Herzog explains his view of the future.

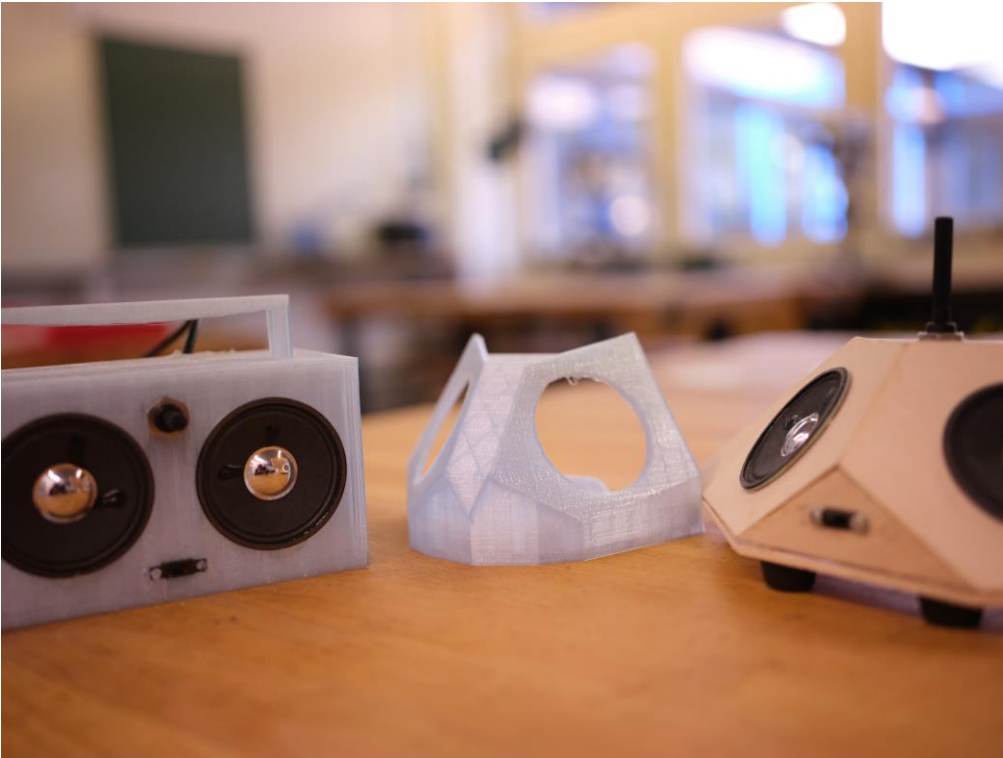
Sebastian Faber and his pupils are currently printing new tokens with the "HOS" logo for the school carnival for the student council. "We can now print spare household parts in almost no time at all," says Mr Mann. His next project will be to design saxophone mouthpieces for music classes. "Then, every pupil can use his/her own mouthpiece with the school instruments. This will be much more hygienic than before," explains Mr Mann.

"Without the coronavirus pandemic, this idea would probably not have been born and

implemented this quickly. The possibilities of creating something new from a plastic cord with a diameter of 1.75 millimetres, something that is useful, something that makes our lives easier, and something that makes us want to experiment and experience the future: This is the appeal of this technology," says Mr Herzog.



Sophia Friedrich is currently preparing for her general qualification for university entrance in physics. As everyone experiencing the possibilities of 3D printing, she is fascinated by the technology. Photo: Tim Birkner



Pupils used to make stereo loudspeakers from plywood; today, they design the housings on the computer and print them. Photo: Tim Birkner



Fast, practical, and available: The new tokens for the next school carnival are made in the HOS workshops. Photo: Tim Birkner



Sebastian Faber and his students have been able to gain experience with 3D printing for five years. "This is incredibly motivating, the pupils often sit at home for hours and design their ideas. They are crazy about the technology," says Mr Faber. Photo: Tim Birkner