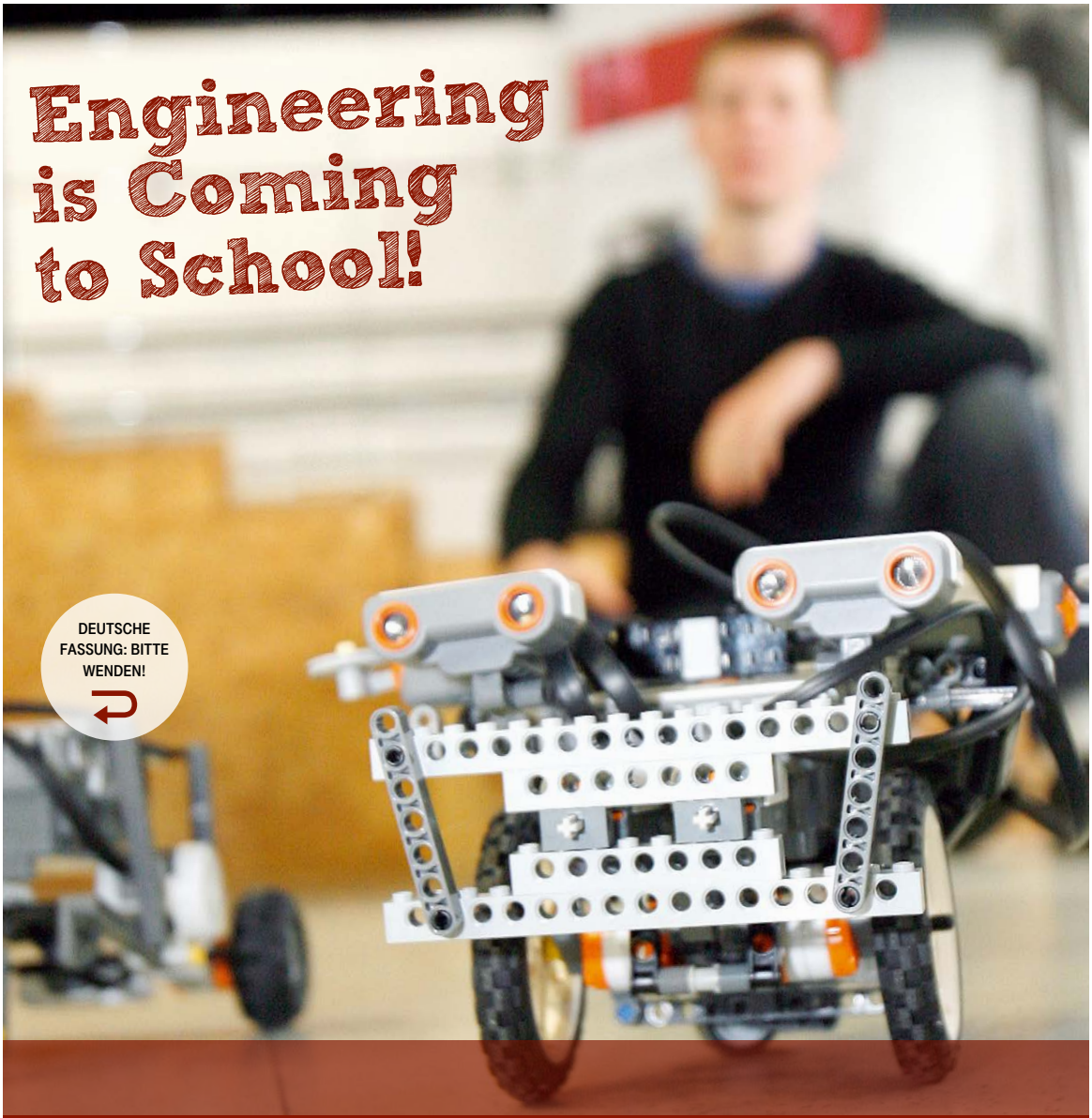
Engineering is Coming to School!



DEUTSCHE FASSUNG: BITTE WENDEN!

Junior Engineer Academy

Engineering education in cooperation with European partner schools

Deutsche Telekom **Stiftung**

Contents

Deutsche Telekom Stiftung is a foundation that has been committed to improving education in science, technology, engineering and mathematics (the STEM subjects) since its founding in 2003. In 2005, we created the Junior Engineer Academy to spark students' interest in engineering and do something to address the growing shortage of engineers. This model for exciting, hands-on engineering class has taken root at nearly 80 schools throughout Germany and spawned a raft of imitators.

Now, we want to step outside Germany's borders and share our experience with this successful program with interested partners in other countries. Deutsche Telekom Stiftung feels very strongly about European integration. Through this exchange, our aim is to learn what methods and approaches our European partners use to teach science and engineering at their schools.

I hope that an international dialog through the Junior Engineer Academy will start a lively exchange about good STEM education.

Prof. Wolfgang Schuster
Chairman of Deutsche Telekom Stiftung

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THE JEA MOTIVATES AND FASCINATES MY STUDENTS. MANY HAVE SUDDENLY REALIZED HOW MUCH THOUGHT AND VISION GOES INTO THE TECHNOLOGY THAT WE USE EVERY DAY. AND FEW THINGS INSPIRE STUDENTS AS MUCH AS A PROJECT WHERE THEY MAKE THEIR VERY OWN SOPHISTICATED PRODUCT.

”

Tobias Bauer, high-school engineering teacher at Gymnasium Bayreuther Straße in Wuppertal

Unique, Successful Model

The Junior Engineer Academy prepares young people for an increasingly digital, engineered world.

Engineers are some of the most sought-after workers in the world. However, many young people still choose other careers. Sometimes, it's because they don't know what engineers do. Sometimes, it's because schools are unable to nurture deeper interest in science and technology on their own.

That is unfortunate: a solid STEM education (science, technology, engineering and mathematics) and good media skills are more important than ever before. And not just for a future career. Our globalized world is becoming increasingly digitalized and engineered. Young people can only become valued members of society with fulfilling lives and successful careers if they learn basic science, technology and computing skills as part of their general education.

Knowing this, Deutsche Telekom Stiftung decided in 2005 to develop the Junior Engineer Academy. The JEA is a uniquely hands-on model for teaching students science and engineering in a highly relatable way. Students independently develop solutions to real-life engineering problems – and acquire a newfound interest in science and technology in the process.

Today, over ten years after the program began, the Junior Engineer Academy is a highly regarded successful model. Over 3,500 students aged 13 to 15 have attended Junior Engineer Academies. Many of them benefited tremendously from the experience when choosing careers or college programs.

Deutsche Telekom Stiftung shares its knowledge and project experience with all German and international schools interested in giving their students an entirely new perspective on science and technology by networking with companies and universities.

Favorite Class: Engineering!

Every Junior Engineer Academy revolves around combining theory and practice in an exciting way.

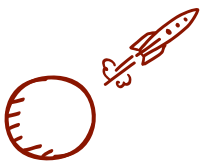
Most students have no idea what engineers do or how electric vehicles, steel plants or robots work. But these are everyday topics for students at a Junior Engineer Academy. The hands-on approach shows the teenagers how engineers and scientists research and work – not just in theory, but in practice as well.

A Junior Engineer Academy creates space in the school schedule for an interdisciplinary science and technology class. Being a two-year program, JEA is firmly integrated in the school curriculum. Most importantly, it has the schools work with companies and universities in teaching the material.

The choice of material is entirely up to the schools. Many projects can be vehicles for teaching science and technology topics in an accessible way: from programming a mobile app to building a photovoltaic system. Close, frequent contact with project partners gives students unique insight into possible careers or study courses. They can network with training managers and trainees at participating companies or explore STEM majors and experience college life at partner universities.

Setting up a Junior Engineer Academy obviously helps students and teachers. What's surprising, though, is how much it helps the entire school. The new class creates permanent links between schools and companies or universities and helps to develop a specific profile in science and engineering.

Exciting projects come from partnerships with companies and universities. Here are six examples:

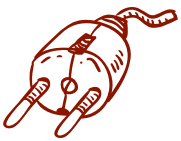


Walking on Mars

Space: the final frontier. In Aachen, junior engineers can stride across the Red Planet in a lifelike simulation on the local university's holodeck. The teenagers also get to build and program their own robots with expert guidance from scientists and engineers at high-tech companies.

The Rainmakers

The junior engineers at a high school near Cologne are learning about wind and the weather. They visit the weather desk at TV station RTL to see first-hand how meteorological data is sifted and analyzed to produce a daily weather forecast. Station employees then help them prepare their own weather forecasts and try their hand at presenting them in the studio.



Electrifying

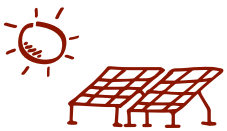
Junior Engineers from the Rhineland experienced a high-voltage program. In the theme session on power engineering and supply, the students from a school in Moers were able to take a first-hand look at the day-to-day work at a local power utility. The high point of the day was just that: the students got the opportunity to climb a power pylon themselves.

Good Connections

Glue can hold together objects as large as a car body, as students at a high school near Bremen learn from industry partner Mercedes Benz. The teens apply their newfound knowledge to building car models of their own – along with a crash track for testing the sturdiness of their designs.

From Ore to Steel

Students in industrialized Duisburg not only learn how ore and coal become steel, but they get to make pig iron themselves – all thanks to a furnace simulator at the local university. The iron is then forged for as long as it's hot.



Solar Sailing

Students at an academic secondary school near Bonn launched their own home-made speedboat. The boat was powered by four solar modules installed by the students themselves. In addition to roaming the Rhine for several hours, the vessel was then also presented at an energy fair and reached the final round of the Focus student competition.

JEA Goes European

This unique project is coming to schools and students outside Germany.

More and more German schools have launched Junior Engineer Academies because they make learning about technology fun, accessible and hands-on. Their track record is impressive, too. In 2016, Deutsche Telekom Stiftung decided to share the benefits of this unique program with schools in Central, Eastern and Southeastern Europe, particularly in Albania, Croatia, the Czech Republic, Greece, Hungary, Poland, Romania and Slovakia.

Existing JEAs in Germany are used to establish international school partnerships in which both sides collaborate on science and technology projects. In addition to acquiring engineering know-how, students and teachers also get to improve their intercultural and foreign language skills.

The collaboration consists of the following activities:

- Teachers from Germany and the partner countries visit one another in order to prepare for exchanges.
- During an exchange, students at the partner schools collaborate on engineering projects.
- Teachers from the partner countries can attend the German project network's annual conferences and share their JEA experiences with colleagues.
- Schools in partner countries can get in touch with schools in Germany through a contact seminar.

In this project, Deutsche Telekom Stiftung cooperates with two German institutions that have a long track record, extensive experience and a large network of foreign schools:

Educational Exchange Service
Since 1952, the Educational Exchange Service ("Pädagogischer Austauschdienst" or PAD) has been the only government institution involved in international exchanges and scholastic collaboration under the auspices of the state ministers of education and cultural affairs. PAD has been the national agency for EU school programs since 1995 as well.

Central Agency for German Schools Abroad
The Central Agency for German Schools Abroad employs approx. 90 staff members and 50 advisors to advance its international mission. It provides staffing and financial support for around 1,200 schools worldwide, including 140 German schools abroad that are generally managed in public-private partnerships. These institutions are staffed by about 2,000 foreign service teachers, program teachers and advisors. While working abroad, these individuals receive organizational, educational and financial assistance from the Central Agency for German Schools Abroad.

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WE GET TO TRY OUT A LOT OF THINGS OURSELVES IN THE JEA: WE LEARN HOW TO USE MEASURING INSTRUMENTS AND BUILD ROBOTS THAT TRACK THE SUN. I LIKE THE FACT THAT WE CAN EXPLORE CAREERS THAT WE HAD NEVER EVEN HEARD OF. THAT’S A GOOD ENOUGH REASON FOR ME TO STAY AT SCHOOL LATER EVERY NOW AND THEN.

”

Rebecca Schöller, JEA student at Alexander-von-Humboldt-Gymnasium in Schweinfurt

Practical Tips

Here's how to benefit from the Junior Engineer Academy's experiences.

Do you want to use the approach pioneered by the Junior Engineer Academy to make technology classes a more integral part of your school's curriculum? To help you, we've put together some tips for designing, preparing and implementing a Junior Engineer Academy.

1. Baseline

The Junior Engineer Academy is a STEM educational project conducted in cooperation with university and industry partners. First, find out what your school and local community have to offer: Are there already science and technology projects at your school? What companies and scientific institutions are located in your region? What topics can you cover with potential partners? What human and financial resources can the partners contribute?

2. Preparation Phase

Building an External Network
Before you start outlining your Junior Engineer Academy, it's worth checking whether you have any contacts you can use for a joint engineering project: What companies or universities have relationships with your school through activities such as presentations, company tours, student internships or competitions? What other local companies and research institutions could potentially serve as partners?

Planning
Engineering projects like the Junior Engineer Academy combine applied projects with preparatory and follow-up lessons on the theory behind the projects. When developing a teaching plan, you should make sure to give students as many opportunities as possible to work on real-life projects and develop engineering solutions on their own. Whatever field your engineering project tackles, your teaching plan should cover every phase of the project. The following questions can help with planning:

- What specific engineering problem will students be attempting to solve?
- How do you want them to do the work?
- What tools do you want them to use, and to what end?
- How should students evaluate the result?
- What are the specific learning objectives?

To identify areas of interest for engineering projects, you should compare your school's resources and capabilities with those of potential university and industry partners. Can the partners provide insights into engineering education and careers? Are there any STEM subjects that could be fruitfully explored together with participating companies and universities? These subjects should be integrated into every part of your teaching plan.

Scheduling Class Times and Locations
The Junior Engineer Academy is a two-year program. It is designed to be long-term in order to have a lasting impact on students. JEA classes are best scheduled at the end of a school day. This way, excursions and internships won't conflict with the next class period. Plus, the class will have more flexibility to arrange company and university visits.

Class Size
The ideal class size depends on the school's needs and the partner's resources. Schools generally try to make classes as large as possible due to the available number of hours. Universities and companies, by contrast, often prefer smaller classes in order to give students the best possible work conditions in laboratories and workshops. A good rule of thumb is to keep the class size between 15 and 20 students.

3. Project Phase

Kick-Off Event
We recommend holding a special event to kick off a JEA as a special educational project. This can be done at the school or at the partner company or university. This is a good opportunity for the principal, teachers and partner representatives to introduce themselves so the students and their parents know what the project has in store for them.

Implementation
Each Junior Engineer Academy develops a unique profile during planning and execution, largely based on the project topics and the partners' resources. It is important to alternate meeting places between the school, university and company in the course of the project.

Student grades can be based on tests as well as the following modules and criteria:

- Documentation
- Diary/folder
- Written examinations
- Oral examinations
- Participation
- Final presentation

Media and Public Relations
As the Junior Engineer Academy is a very special project, we think it deserves a good deal of media attention. Luckily, it consists of numerous activities that make excellent news stories. Kick-off events, closing ceremonies, excursions, trade fair visits, trade show presentations and open-house days are all excellent PR opportunities.

4. Final Phase

Closing Ceremony
Every Junior Engineer Academy should finish with a closing ceremony. It gives students an outstanding opportunity to present their project idea and results to an admiring audience made up of parents, teachers, fellow students, representatives of participating companies and universities and possibly even journalists. This is also an ideal occasion for presenting students with their certificates of successful participation.

Evaluation
Once the project is done, teachers, students and cooperation partners should jointly evaluate the Junior Engineer Academy in order to document their experiences for future reference. They can also explore opportunities for improvement and further development. The students can evaluate the Academy using a questionnaire, for example. It is also a good idea to compare notes with the participating partners and talk about future JEA projects as well.

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AS A JEA PARTNER, WE GET KIDS EXCITED ABOUT REAL-LIFE ENGINEERING. WE HAVE THEM TAKE APART A 911 ENGINE OR RUN CABLES FOR LIGHTING EQUIPMENT. FOR US, THIS IS ABOUT MORE THAN PROMOTING YOUNG TALENT. WE ALSO FEEL THAT WE HAVE A RESPONSIBILITY TO HELP SCHOOLS PROVIDE CAREER GUIDANCE.

”

Stefan Kriester, master trainer
at Porsche Leipzig

The Benefits

Every JEA owes its success to the joint efforts of many people.
And all the partners benefit from the project.

Students ...

- Get a first-hand glimpse of science and engineering majors and careers.
- Learn about technology by applying it to real problems and developing their own engineering solutions.
- Learn how to use special equipment and applications.
- Build networks for their future careers or university education.
- Gain project experience early on.
- Improve their teamwork and communications skills.

Universities ...

- Ease the transition from school to college.
- Educate high school students about STEM majors.
- Start developing young STEM talent at an early age.
- establish links to companies.

Companies ...

- Get students interested in potential careers in their industry.
- Build relationships with schools for filling internships and traineeships.
- Can present themselves as potential employers.
- Start developing young talent among at an early age.
- Position themselves as a local education partner.

Schools ...

- Strengthen their reputations as STEM leaders.
- Add real-life projects and applications to their curriculum.
- Connect with competent partners in industry and academia.
- Receive access to advanced equipment and materials not normally found in a school setting.
- Benefit from participating in a regional network with industry and university partners.

Deutsche Telekom Stiftung

Deutsche Telekom Stiftung is a foundation established in 2003 to strengthen Germany's position as an education, research and technology leader. With an endowment of EUR 150 million, it is one of the country's major corporate foundations. Centered on improving education in Science, Technology, Engineering and Mathematics (STEM) as well as in digital learning, its activities cover the entire educational chain: from early education and learning in and out of school, to teacher education and training. And Deutsche Telekom Stiftung is committed equally to providing broad support as well as fostering the high talents of tomorrow.

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