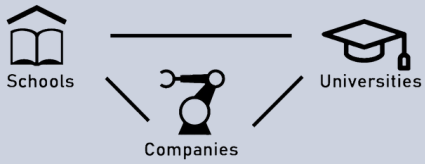
first cycle

Dear Ladies and Gentlemen,

We are pleased to announce the successful completion of the first official cycle of Authentic-STEM, which concluded in early June with the "Forum of Innovation". As we reflect on the past four months, we are proud of the extensive problem-solving processes and collaborations that took place between students and their mentors, representatives from Alsco, BETA Technologies, onsemi, TMD Friction, Clarkson University and the University of Siegen.



The project Authentic-STEM addresses the skilled labor shortage in the STEM area. As an innovative project for vocational orientation, it wants to give students the opportunity to work in intercultural project teams on substantial and authentic mathematical problems which arise in companies. Students get the chance to see how they can apply their school knowledge in real-world work experiences and develop competencies in digital and intercultural communication and problem-solving. We work together with companies to identify problems (e.g. modeling, optimization, big data, product design, etc.) for the students to work on. In Solver-Teams with German and US students together they search for solutions, accompanied by mentors from the mathematics education institute at the university of Siegen and students from the Clarkson University.

looking back

During the past few months 54 students have worked together in nine Solver-Teams to find a solution for eight individual problem statements of four international operating companies. Students from gis Washington, FEH BOCES in Malone, CV-TEC in Plattsburgh, JFK School in Berlin, Maria-Wächtler Gymnasium in Essen, Gymnasium in Höchstadt a.d. Aisch, Sankt-Ursula-Gymnasium in Attendorn, St.-Franziskus-Schule in Olpe, Gymnasium Maria Königin in Olpe and the Städtisches Gymnasium in Olpe participated in the project. They were accompanied by mentors from Clarkson University and the University of Siegen and representatives from various companies, namely Alsco®, Beta Technologies, onsemi™ and TMD Friction.

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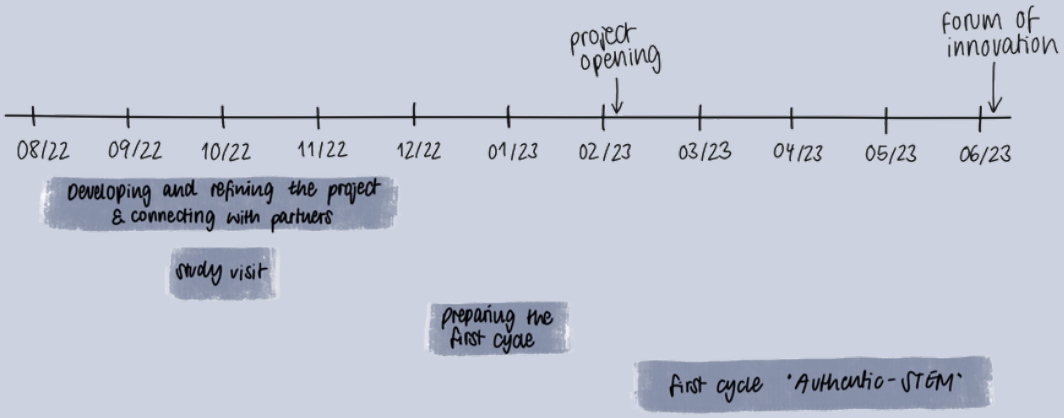
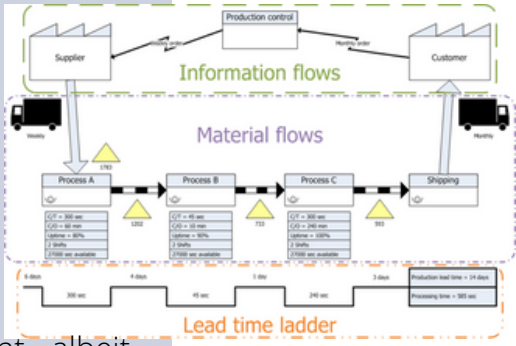


Within the cycle, the Solver-Teams were facing different challenges and found numerous ways to overcome them. But read for yourself:

Alsco 1 & 2: *Optimization of processes through Value Stream Mapping at the locations in Cologne (GER) and Lanham (USA)*

The two Solver-Teams, who worked together with Alsco, were given the same problem statement. Both teams initially faced difficulties in understanding the task but managed to overcome them through research and communication with their mentors. During their problem-solving process, the two groups searched and explored different software options capable of creating a Value Stream Map. They collaborated and tested Excel. However, in the subsequent weeks, the solver-teams split up again, with Alsco 1 continuing to use Excel while Alsco 2 focused on Google Spreadsheets and the potential to export data from the sheet. Most of the students had the opportunity to attend both company visits, either digitally or physically, and incorporated their observations into the creation process of the Value Stream Map. Both teams encountered challenges and successes, ultimately coming up with highly efficient, albeit different, solutions. They employed distinct strategies in their collaborative work. Alsco 1 predominantly worked independently, while Alsco 2 divided up responsibilities and maintained frequent communication through weekly meetings. Nevertheless, at the end of the cycle, both Alsco 1 and Alsco 2 developed well-structured Value Stream Maps, which they presented to the company representative at the Forum of Innovation.



Beta 1: *demonstration of how electric current can create a magnetic force that can move a magnet away in a circle*

After some initial inhibitions to communicate in English the Solver Team Beta 1 began trying to understand the problem and exchanging initial ideas. After a meeting with the company's representative, the students began dividing the tasks. The German students worked on a presentation explaining the theoretical background of the model and their American counterparts developed and built the model. After their visit in the company Beta 1 could reflect their goals, achievements, open questions and took notes on what they've already achieved and what they still plan to do. They overcame the challenges they experienced during the cycle and came up with a good solution. They were eager to present to the company representatives as well as other stakeholders. The presentation of Beta 1 not only included a presentation of their model but also on the theoretical background of their solution and what their solving process looked like.

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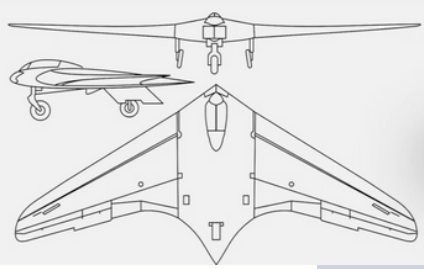

Beta 2: ***demonstration of "lift over drag" and how improving the ratio can improve the flight range of an electrical plane***

After getting to know each other, Beta 2 quickly began trying to understand the problem and exchanging initial ideas. After another meeting with the company's representatives to figure out what was expected of them, the students were motivated to further develop their ideas. The Solver Team decided to divide the tasks. The American students first worked on the presentation of the theoretical background, while the German students developed a model. During the problem-solving phase there were an opportunity to visit the company. With the newly gained information, the Solver-Team could take notes on their steps so far and beyond in the future. Quite at the end of their problem-solving process, the German students were inspired to add another component to their model. They decided to build a wind tunnel out of cardboard boxes and a blow dryer whilst their American counterparts worked on a model made of balsa wood to present the effect of weight distribution. Both parts were able to present their solution, even though the wooden model broke right before the presentation during testing.

Beta 3: ***demonstration of charging and discharging processes in a cell through the lens of Lithium-Ion battery technology***

Beta 3 quickly began trying to understand the problem and exchanging initial ideas, which first went in the direction of creating a 3D computer model. After another meeting with the company's representative, the students realized that the company was looking for a more concrete solution, so they further develop and adapted their ideas. The Solver Team divided tasks: American students built the model while German students focused on research and contributed to its further development. After the company visit, the team observed what they achieved so far and what they still need to do. At the presentation they presented their model and the theoretical background on batteries, the charging and discharging process, and combustion engines vs electrical engines as well as what their solving process looked like.

onsemi: ***Drafted prototypes to assess abilities for a job as a maintenance technician***

The onsemi Solver-Team faced challenges due to its large size but managed to work well together as a Solver-Team. Despite occasional disagreements, students learned effective communication and respectful collaboration across the Atlantic. Some students took the lead in creating presentations and sharing designs, while others pursued individual ideas and presented their findings to the group. The main task was to develop a solution for better candidate interviews involving hands-on skills using kits. Students combined ideas, which skills would be needed as a technician and concluded that a combination of two building kits, a fire-truck-kit and an electric circuit kit, would work best as an assessment. Presentations by various groups received positive feedback, and students from FEH BOCES had the advantage of visiting onsemi to gain valuable insights into the company's expectations and manufacturing processes.

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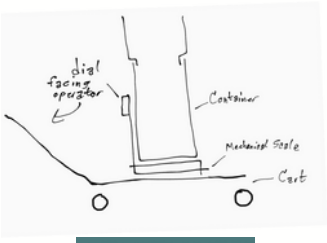
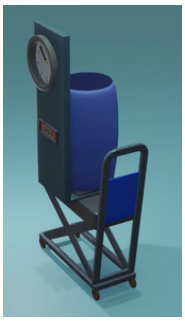
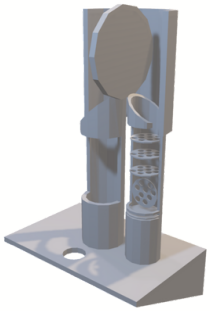
TMD 1: *Determination of fill level of powder coat in a container*





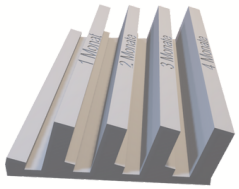
The Solver-Team of TMD-Friction 1 collaborated effectively, utilizing their diverse expertise to analyze and solve the given problem. Some group members focused more on the theoretical part while some others focused on the practical implementation. Safety restrictions and unalterable components posed challenges, but the team brainstormed ideas and sought clarification from the company representative. This iterative process led them to devise a solution involving a specially designed mechanical spring scale that met safety requirements. Despite only one team member attending the Forum of Innovation, they prepared a comprehensive presentation, incorporating physical formulas and a 3D animation to explain their solution. One team member's visit to TMD-Friction at the cycle's start provided valuable context and aided in interpreting the provided images and understanding the physical constraints.

TMD 2: *Reference samples and visual test equipment for the kneader knives*

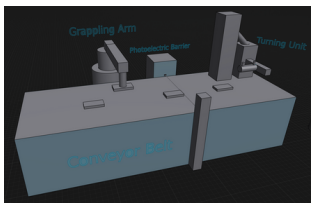


Each team member focused on tasks that aligned with their strengths and expertise. Initially, they devised a solution that involved automated sampling of ground material to assess the quality of the knives. However, they realized that implementing this idea practically within the facility would be challenging and nearly impossible to implement so the team had to brainstorm for a new solution. They maintained regular contact with the designated contact person at TMD Friction, ensuring a continuous exchange of information and feedback. The

team created various 3D models to visually represent both their initial idea of a solution and their final solution, making them easily comprehensible. Two out of the four team members had the opportunity to visit TMD Friction, enabling provide the rest of the group with a broad overview of the involved machinery and processes.



TMD 3: *Ensuring a gap between the brake pads after the turning process*



The team regularly met as a whole, working together to find a solution. They effectively divided tasks among themselves, ensuring a productive distribution of responsibilities. While one group focused on understanding the physical constraints, another group brainstormed the most optimal implementation of the solution within the operation. They began by 3D printing models of the brake pads to aid in their analysis. Right from the start, they worked cohesively towards a solution, continuously refining their ideas. They evaluated their concepts using relevant physical formulas to ensure their viability. To visually represent their ideas, they generated a 3D model, a video showcasing the solution concept, and various sketches, all integrated into their presentation. Additionally, two team members visited the company during the Easter break, which conveniently fell in the middle of the project cycle. The insights they gathered through targeted observations within the company significantly contributed to further refining their solution.

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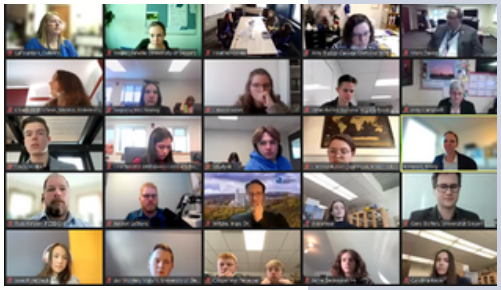

forum of innovation

The cycle ended with the highly anticipated two Forums of Innovation on June 5th and 6th. The Solver-Teams were given the opportunity to present their solutions and problem-solving processes to a broad audience. After greetings, the Solver-Teams did their presentations in dedicated Breakout Rooms to the company representatives, supporters and partners of the project as well as other interested people. Afterwards, they proudly received their well-earned certificates and kind words from the company representatives they collaborated with the last couple of months.

looking forward

With the completion of the current cycle, the University of Siegen team is now dedicated to evaluating it and making improvements for future cycles. The focus now shifts to preparing for the next cycle of Authentic-STEM, scheduled to commence in spring 2024. We extend our heartfelt thanks to all those who participated or contributed to the success of the first cycle, and eagerly anticipate the many prosperous cycles that lie ahead.

your Authentic-STEM team

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