

Improvement of the career choice process in technical and scientifically based VET

CoCo+

a project in the framework of the European programme ERASMUS+

**Intellectual
Output IO1**

SOLARIS CAR MODEL COMPETITION

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1. General information

CoCo+ project

A few regions all over Europe face comparable challenges regarding local labour market:

On one hand a well-developed or emerging industry exists in such regions that regular needs a lot of new skilled workers for the local economy. On the other hand, those regions face a mostly too high dropout rate of school leavers in formal schools as well as in professional education.

For that reason, officials search for new methods to attract young people in an early stage of their childhood to special fields of education and to develop their special interests. Such methods should focus on all local needed skills and prepare adolescents in an ongoing process for their upcoming professional education. As earlier such processes begun and as better the career guiding process was managed as better European regions will satisfy and fill the needs of their local economy. The prevention of dropouts can also increase significantly in that process.

Competitions for students are an excellent method to attract and interest young students in an early phase of their education. All students love to compete with each other. It opens up the chance to show own skills and to recognize the reached level in a direct comparison. Adapted to important regional themes and local needed skills such contests can provide a very good contribution to the existing challenges of any European region.



Picture 1: European guests and participants of the German multiplier event

The project called “CoCo+” (Cooperation for Competition) pay attention to this field of vocational preparation and orientation of pupils. Educational organizations of 6 European countries collaborate in the project for a three years’ implementation period from 2017 to 2020. The strategical partnership is embedded in the framework of professional education of the European programme ERASMUS+.

Some of the collaboration partners are well experienced with student competitions. They regularly organize competitive events for some years mostly in technically or scientifically fields. Other partners are newcomers, interested in a useful approach for methodology and contents to develop own abilities to adapt and organize such events in their local or regional European context.

It's the final goal of CoCo+ that all partners develop and rise their competences for professional orientation processes, to learn from each other, to describe the methodical approach in some free available intellectual outputs and to open the chance for other European regions to participate in the results and to adapt the described approach for their own challenges.

This brochure – the intellectual output IO1 – describes some aspects of the German / Saxony multilevel technically competition – the solar car model competition solaris-Cup.



Picture 2: International participants of the solar car model competition and their teachers showing certificates



Picture 3: Composition of pictures showing facets of the participation of the the solar car model competition

Competition “solaris cup”

Pupils of different ages get some basic technically equipment as well as the main rules for the categories of “solar car models”. In a period of about half a year they prepare an own solar car model in groups of up to three participants. They are supported by suitable mentors as technically teachers, their families as well as staff of collaborating companies. Participants finally compete in local, regional and also national events with other people like them. In the creation process participants develop and exchange their knowledge for instance in the fields of renewable energy, mobility or electronics. In the competition they are also tested for their knowledge in such fields. Mostly they also prepare some individual presentation of a given main theme.

The solaris cup competition was first time held in year 1999 when new challenges of solar technology and electric mobility were published on an early stage. Later on it was step-by-step developed by the years and has increased by spreading the idea to new schools, regions and target groups every year.

The event is a product of an ongoing collaboration of local educational and economical partners leaded by an organization that prepares and organizes the competition event every year. The local Chemnitz competition as well as the Saxonian event was implemented under responsibility of the German CoCo+ partner solaris FZU for many years. After a few years the Saxonian competition became part of a German wide initiative of the German Federal Ministry of Education and Research and the German Association for Electrical, Electronic and Information Technologies (VDE). That initiative has included about 15 comrisable German local/regional competitions in a new competition level - the German national level – held ten times at different German places. For the years 2019 – 2021 it is planned that the promoter solaris FZU will implement the following competitions:

- the local level of Saxonian cities as Chemnitz, Dresden and Leipzig,
- the regional Saxonian competition and
- the national German competition



Figure 1:
German locations of solar car model competitions

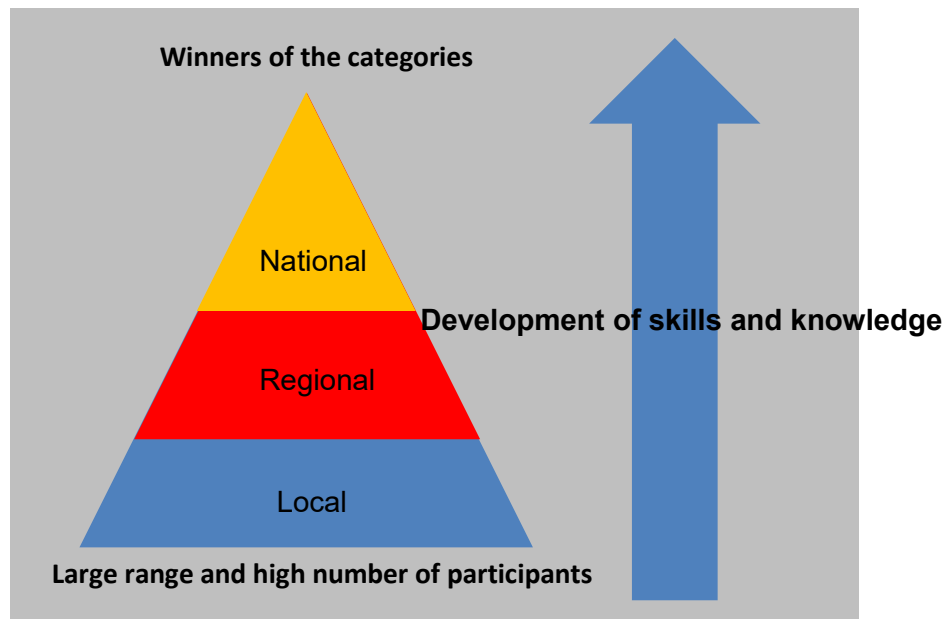
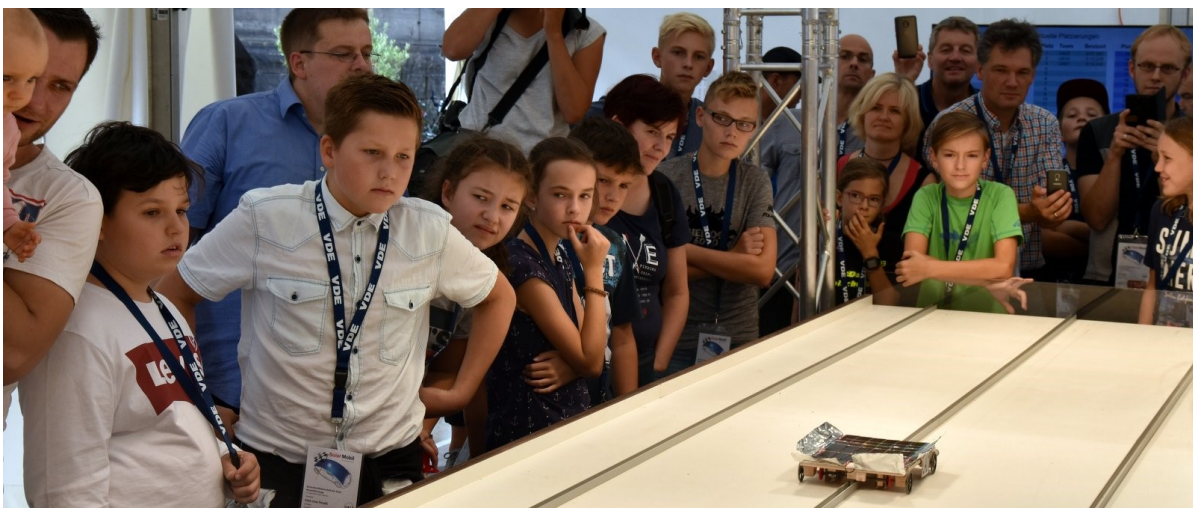


Figure 2: Levels of participation

The participation develops mechanical skills as well as technical competences in the fields of solar technology, electronics and electronically devices as well as drive systems, electric mobility, renewable energy and sustainable development for the participants of all genders.

As a part of the ERASMUS+ project CoCo+ some students of the collaborating countries got the chance to take part in the competition in fall 2018 in the German City of Chemnitz in a blended mobility / multiplier event. They were supported by some teachers of their professional schools. About 40 international guests were welcomed for that special project activity.



Picture 4: Participants and guests observe one of the races of the solar car models

It was one of the main goals of the project CoCo+ to infect new persons with a “competition virus”. The teachers as well the participants gained all necessary competences to develop their own local / regional competition in future. They are ambassadors of the given methods and ideas in their home countries now. They got the possibility to adapt the tested methods for the different conditions (education system, labour market) and special challenges of their European countries.

Most of the included pictures in this brochure are taken during the German multiplier event in 2018. They show the parts of the competition, the produced solar car models as well as the enthusiasm of all the participants. In background they also show some necessary preparations for such an event.

The original goals of “solaris cup” are:

- Raising enthusiasm of young people for topics as electric mobility, renewable energies and future technologies
- Technical construction of solar powered model solar vehicles
- Stimulation of creativity and of technical skills
- Individual development of participation of young people in a career guiding process
- Spreading of general information of all the main themes in the society
- Collaboration of a wide range of organizations, companies and promoters

National and international effects

- 14 regional competitions were held in 2018 all over Germany
- All competitions were organized in partnerships led by schools, universities, regional associations, energy providers and others
- Special national and international response:
 - SolarMobil Italia (initiated by Jakob-Fugger-Gymnasium Augsburg)
 - Solar model course for 11-14-year-old students at the junior university Wuppertal
 - Solar workshops in international schools
 - European participants in the framework of the CoCo+ project from Czech Republic, Croatia at the German national competition implemented in Chemnitz 2018
 - Involvement of other European participants from France and Italy

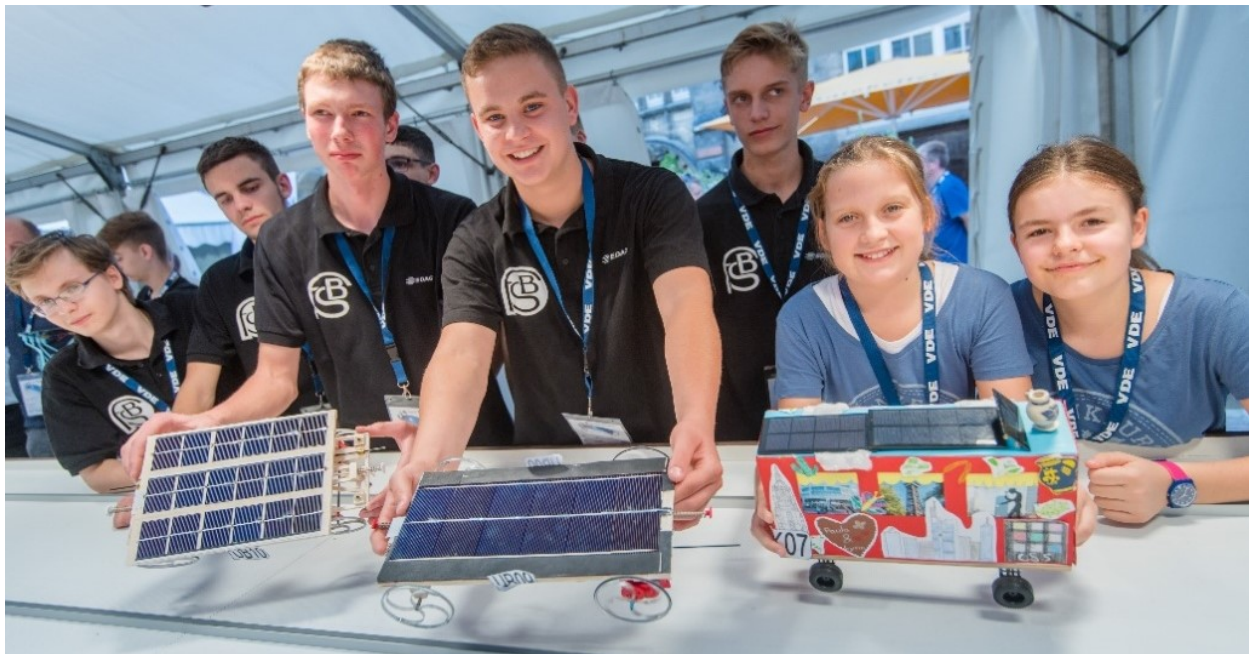


Picture 5: Participants and guests during prize-giving ceremony

2. Preparation

Participants

The solar car model competition is aimed for pupils of the age from 10 to 18 years from any school types. On German nations level yearly around 150 participants are divided into around 60 teams. Three-stage model: the local and regional competitions send the winner to the national final competition.



The content of the competition should help the participants to get to know the solar cell, to take care of mechanical problems of the vehicles and to deal with cross-topic tasks. With the future potential of the contribution to the energy supply, solar technology also represents a current field of expertise with which some of the participants will continue to work in the future. For some of the participants, the transition from school to work or vocational training is imminent and can serve as orientation for the students. In any case, the participants have accompanied a project that comes from the field of "MINT" - mathematics, computer science, natural science and technology.

Implementation and technical regulation

The invitations to tender clearly specify which components may and may not be used. Solaris provides the students with kits. However, the children do not have to use all components. However, the technical specifications of the components are mandatory, so the students have some leeway, but in order to keep the conditions similar for everyone, there are rules and limits that must be strictly adhered to and strictly controlled. Also the size of the solar car is prescribed and the students must stay within the given range. Furthermore, it is essential that the solar-powered vehicles get all their driving power directly from the sunlight and in addition, the mobile should be built from renewable and recyclable materials.

For boats with propeller, the kit contains 1 solar panel (0.5 V/ 4.6 A), 1 motor, 1 bracket and one propeller. For the boats with propeller, the kit contains 1 solar panel, 1 motor, 1 bracket, 1 propeller and 1 stern tube. The creative class for the boats has in its kit 1 solar panel, 1 motor and 1 bracket. It is obligatory to use the motor and the solar module from the kit issued by us. In addition, a poster is mandatory for each team.

For the racing class Traditionally for solar cars, the kit includes 2 solar modules and the gear set with motor and bracket. The participants are only allowed to use the specified engine and solar modules, but are free to choose or optimize the gearbox. In the kit for the racing class Solarauto Kreativ there are 2 solar modules and 1 gearbox kit with motor and gearbox, but the students can also use their own solar module with a maximum total size of 512 cm² and neither motor nor gearbox must be used from the given kit. In the kit for the racing class solar car with direction switch there is 1 solar module (up to 350 cm² total size), gearbox kit with motor and bracket and 1 Gold/Green- Cap 5,5 V with a capacity of 0,1 F. Each team must design one poster per vehicle and present it to a jury.

POSTER PRESENTATION

Every year we change the theme to be worked on and presented for the posters to be presented. However, the theme always deals with the mobility of tomorrow, sustainability and other future topics.

The layout of the poster is made available to the teams, which the students* have to fill with their content.

It is obligatory for the participating teams to send a poster to the organisers before the competition, so that the organisers can still take care of printing the posters. Furthermore, it is mandatory that on the day of the competition the team has to present their poster to a jury of experts.

SELECTION OF WINNERS

- In each category, winners and runners-up will be determined and the first three in each category will be awarded prizes. In the fast vehicles or boats (boats with ship's propeller, boats with propeller, racing class traditional, solar car direction switch) the fastest mobile will win. In the "Creative" categories, a jury will determine the winners by means of a team discussion and a test drive of the mobile, on water or on the race track.
- Prize for the best poster presentation.
- Innovation Award
Yearly changing theme
Promotion of particularly innovative teams (including smaller solar panels, renewable resources, lighting management)

3. Dissemination

As solaris is close to the students and therefore potential participants, solaris has good conditions. Solaris is represented at many schools directly or indirectly by school social workers. In addition, we also provide insights into practice, offer support on project days, hold all-day events in schools and in our facilities, we are SAENA partners and have extra-curricular activities. Through this close contact to the children we can generate many participants, but also the contact to the caretakers, teachers and parents is essential.

4. Sustainability

The objectives we set for the individual participants vary greatly, depending on their age. The younger participants (elementary school age, 6-10) should be made aware of the enthusiasm for technology, mobility and sustainability and should be encouraged to become active and see what they can achieve by themselves. Creativity and craftsmanship should be encouraged so that these skills are not completely neglected in the age of mobile phones and the like.

The participants of the secondary schools and grammar schools (10-18) should be introduced to sustainable mobility and solar technology by working with it and educating themselves in these areas. In addition, this competition is intended to serve as a career orientation and to promote the exchange between interested young people, but also to attract more young scientists and technicians.

A very important point, which is age-spanning, is that the students who participate in the competition work continuously on this one project, with team colleagues, over a relatively long period of time and thus also learn perseverance and train their ability to work in a team, but can also see the results relatively quickly.

Another important objective is to establish long-term partnerships with schools of all types, children's and youth centres, working groups and other out-of-school caregivers. We are also very happy about the multiple repetition of individual children and this strengthens us and our concept.

It is also essential to have secure partners for the competition at the various venues. On the one hand, these should be publicly effective so that the participants can be inspired, but also so that the general public is aware of them. In addition, there are firm ties to various advertising partners, as well as to the local daily newspaper, regional radio and television stations responsible for publicising the competition, but also for moderating the event and for reporting afterwards. In addition, various partners for the rental of special event technology and also possible catering partners have been added over the long period of the event.

5. Annex

General Information about blended mobility

C2 – Chemnitz



Participant countries

Hungary

Czech Republic (2 regions)

Croatia

Participant organisations / schools

Budapesti Gépészeti SzC Szily Kálmán
Szakgimnáziuma Szakközépiskolája és
Kollégiuma (Hungary)



Střední průmyslová škola chemická Pardu-
bice (Czech Republic)



The South Bohemian Company for Development of
Human Resources (Czech Republic)

SrednjaŠkola “DugoSelo” (Croatia)

Participants

Does your organization have any experience in the preparation of own local competitions especially in technically or scientifically fields?

*The South Bohemian Company for Development of Human Resources
(Czech Republic)*

“Talents for Companies is a technical competition focused on support of polytechnic teaching and programming at primary and secondary schools based on the principle of practical training for future employment. The main aim of the competition is to increase the motivation of pupils to study in technical fields and to develop cooperation between primary and secondary schools and the employment sphere. The number of competing teams depends on the availability of technical equipment. Each team must be equipped with a kit containing material for building a functional device, electronic parts, BBC Micro:Bit programming device and tools. The obligation for teams is to build the same functional device within a certain time limit. Each team is formed from 3 students from basic school (10 or 11 years old), 3 students from secondary school (16 or 17 years old) and the captain of the team is an employee of a technical company for example a production company. The captain only advises and coaches the team, the functions are built and programmed by the pupils. There is an identical task for all the teams to construct a functional device using the technical kit and electrotechnical components according to the task and to program the device according to predetermined instructions within a time limit of 3 hours. The course of the competition and the functionality of the device is evaluated by a jury consisting of representatives of the South Bohemian Chamber of Commerce, the Regional Authority of the South Bohemian Region, technical firms, universities etc.”

*SrednjaŠkola “DugoSelo”
(Croatia)*

“Yes, we have organized a national competition in robotics. Our students have been mentors to the students of a primary school and it has been well received. We have also organized an international competition with students from Portugal, Italy, Spain and Turkey also concerning robotics.”



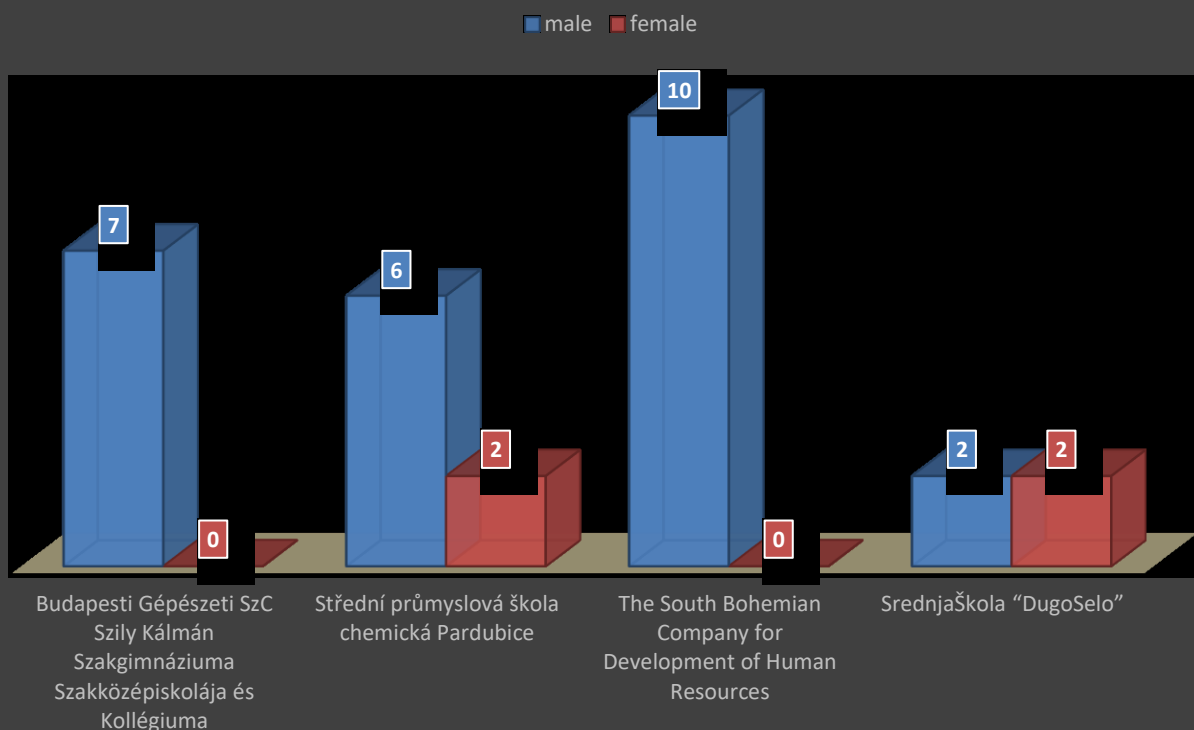
*Střední průmyslová
škola chemická Pardu-
bice (Czech Republic)*

*"Yes we have experi-
ence with organizing
local technical compe-
tition - Finding the best
young chemist."*

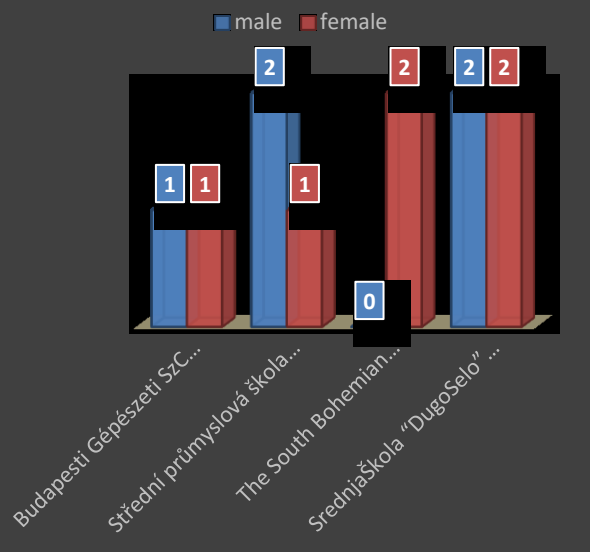
Budapesti Gépezeti SzC Szily Kálmán Szakgimnáziuma Szakközépiskolája és Kollégiuma (Hungary)

"Yes, we organise local competitions in our school. We organise competitions for our technical and vocational student mainly in the field of milling and IT. Our students usually take part in National and International competitions with good results."

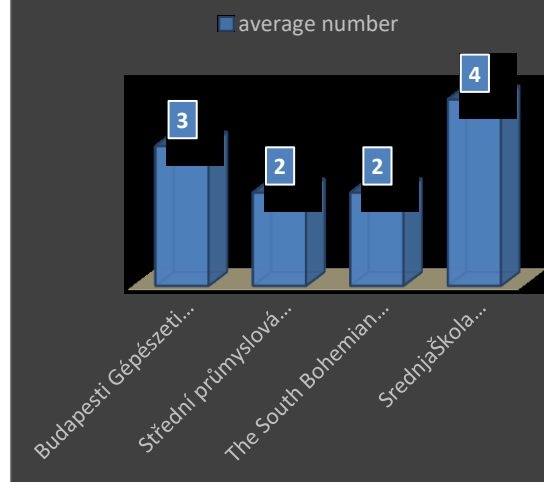
NUMBER OF PARTICIPATING STUDENTS (BLENDED MOBILITY)



NUMBER OF PARTICIPATING TEACHER / OBSERVERS (BLENDED MOBILITY)



AVERAGE NUMBER OF STUDENTS WHO HAVE CONSTRUCTED A SOLAR CAR MODEL IN A TEAM



Who else was involved in preparation, or follow up (teacher, observer, parents, managing staff)? Which tasks have these people fulfilled?

Střední průmyslová škola chemická Pardubice (Czech Republic)

"Observers (project manager and financial manager) also contributed to the blended mobility preparation. They were coordinating and preparing the mobility and transportation. All participants were introduced with coming programme of mobility, financial, logistic arrangements, personal responsibilities, etc. They kept an eye on progress of preparing of solar car models. Steering the creation of posters, checking the quality and appearance of them. Director of the school also contributed with the steering input and technical background. There was one more technical teacher incorporated. He was responsible for setting the students, for construction, posters and leading of students at the very beginning but this teacher had to be replaced because of his work load. New teacher contributed in preparation students for Solar Car construction and presentations of competition. Some parents have supported students - participants with their knowledge, advice how to construct creative and regular Solar Cars. Some meetings with students were conducting in English to improve and prepare them for mobility. "

Budapesti Gépezeti SzC Szily Kálmán Szakgimnáziuma Szakközépiskolája és Kollégiuma (Hungary)

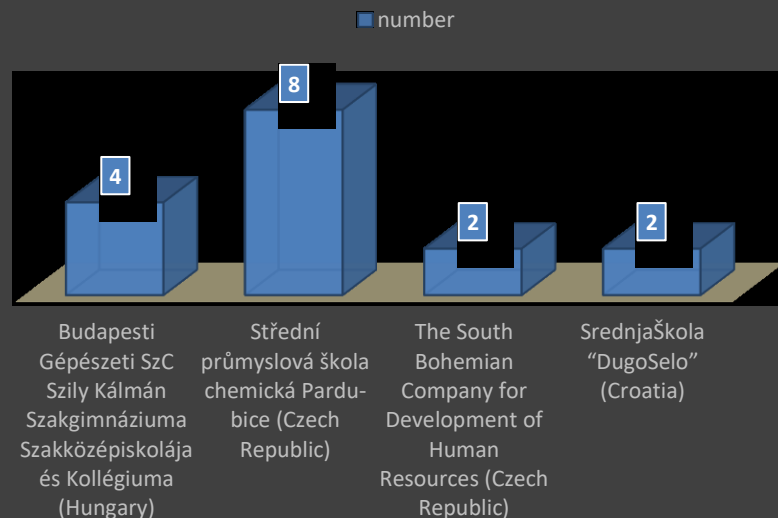
"Two more female teachers were involved; Dr Judit Treitz who is our project manager and Monika Ilcsik, the English teacher of our participating students. They have been mentoring the students in the sense that they have done with them all of the necessary preparations concerning the solar car mechanisms and configurations. Also, there was a need to present the competition to other students in our school therefore they have helped the students participating in making visually appealing posters containing all of the crucial information suitable both for educational and fun fact aspects. Our posters were printed in one of the buildings of our school, where our students learn to become desktop publishers and printing industry engineers. The collaboration with the mentioned teachers and students participating was extremely cooperative and successful in the sense that the awareness of the importance of renewable energy resources has risen with the possibility of making its way to the whole community and not only the students involved."



The South Bohemian Company for Development of Human Resources (Czech Republic)

"In the preparation were involved teachers from schools participating in the project. Each school created team of minimum 4 people (3 students and 1 teacher) and together built the car in the chosen category."

NUMBER OF FURTHER PEOPLE INVOLVED (PREPARATION, FOLLOW UP)



Srednjaškola "DugoSelo" (Croatia)

"Two more female teachers were involved; Božica Posuda and Helena Ivanac-Perutka. They have been mentoring the students in the sense that they have done with them all of the necessary preparations and research of trustworthy websites and books all concerning the solar car mechanisms and configurations. Also, there was a need to present the competition to other students in our school therefore they have helped the students participating in making visually appealing posters containing all of the critical information suitable both for educational and fun fact aspects. The collaboration with the mentioned teachers and students participating was fruitful in the sense that the awareness of the importance of renewable energy resources has risen with the possibility of making its way to the whole community and not only the students involved."

Motivation of participation and goals

*Budapesti Gépészeti SzC Szily Kálmán
Szakgimnáziuma, Szakközépiskolája és
Kollégiuma (Hungary)*

"We have a strong belief that renewable energy resources are vital for our well-being hence we are trying to teach our students its vital importance. Our students in building engineering have to build solar panels and install them. Not to mention the benefits our students get while interacting with international students, seeing how different countries work and learning about their cultures."

SrednjaŠkola "DugoSelo" (Croatia)

"We have a strong belief that renewable energy resources are vital for our well-being hence we are trying to teach our students its vital importance. Not to mention the benefits our students get while interacting with international students seeing how different countries work and learning about their cultures."



*The South Bohemian Company for Development of Human Resources
(Czech Republic)*

"We took part in the blended mobility to gain new experiences in a different country and in a different technical competition. We wanted to increase language, social and technical skills to our students."

*Střední průmyslová škola chemická Pardubice
(Czech Republic)*





"We were eager to see approaches for organizing technical competition from different fields than chemistry. Sharing the good practice. We also wanted to give the students opportunity to try something what they are not specialists in. Our school has different technical branches far from electric and constructing engineering and that means also interesting challenge. Moreover we encourage students to gain international experience in order to develop their personal skills, especially English language."

Preparation phase

Selection process









Budapesti Gépészeti SzC Szily Kálmán Szakgimnáziuma, Szak- középiskolája és Kollégi- uma (Hungary)	Střední průmyslová škola chemická Pardubice (Czech Republic)	The South Bohemian Company for Develop- ment of Human Re- sources (Czech Republic)	SrednjaŠkola "DugoSelo" (Croatia)
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Who has selected the participating students?

teachers involved in the project 	project manager financial manager teacher of physics 	teacher included in CoCo+ 	teacher council 
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How large was the group of students you were able to select from?

 	 	 	 
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How many students did you choose?

			
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Which criteria have you used for the selection?

*Budapesti Gépészeti
SzC Szily Kálmán
Szakgimnáziuma Szak-
középiskolája és
Kollégiuma (Hungary)*

"The most important aspect was their interest in the STEM area without concerning their grades. We tried to find students whose profession in the future would be in a strong relationship with solar panels and renewable energy. It was expected to show interest on the previous dissemination events."

*Střední průmyslová škola
chemická Pardubice (Czech
Republic)*

„Selection criteria were:

- ✓ *Results in the school - to be able to miss some lessons,*
- ✓ *Previous experience with them - already active in the school not only during classes - advantage,*
- ✓ *Knowledge, skills and experience with electricity and construction - criteria evaluated by physics teacher,*
- ✓ *Their availability and will to go was also important.*
- ✓ *It was focused to have 15-18 years old students."*

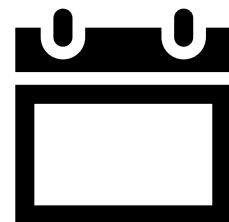
*The South Bo-
hemian Com-
pany for Devel-
opment of Hu-
man Resources
(Czech Repub-
lic)*

"The age, the interest in creating new things, the interest in teamwork, the interest in the solar area, language skills, etc."

*SrednjaŠkola "Du-
goSelo" (Croatia)*

"The most important aspect was their interest in the STEM area without concerning their grades. Next came their extra cullicular activities and their involvement in them. It was important to see how they handle their obligations and whether they have the will and the creativity needed for this particular competition. Also, we wanted both sexes to be involved so it was an imperative to match the number of male and female students."

How long did the selection process continue?



> 2 weeks

2 – 3 weeks

> 2 weeks

> 1 week

Who else was involved in the selection process and how?

Budapesti Gépészeti SzC Szily Kálmán Szakgimnáziuma Szakközépiskolája és Kollégiuma (Hungary)

"Teachers of the professions, class teachers and the management of our school was asked to help to nominate students who could perform well on the professional lessons and can behave well and open to life-long learning. Parental support was essential, too."

Střední průmyslová škola chemická Pardubice (Czech Republic)

"Students in some cases served as advisers and tell us the experience about their friends/classmates possible participants. Parents had to agree with their trip because they are under 18 years. Their class teachers gave us an advice about students and tell us more about their results, gave general feedback."

The South Bohemian Company for Development of Human Resources (Czech Republic)

"Parents, teachers, students, the director of the school"*

SrednjaŠkola "DugoSelo" (Croatia)

"Our students start with vocational education from the 9th grade, this is 1st grade of secondary school in Croatia. The student parents play a significant role in their decision making about their future education. Also, pedagogical services in primary and secondary (vocational) schools try and guide their students in their desired educational directions. The foundation of our educational system is life long learning."

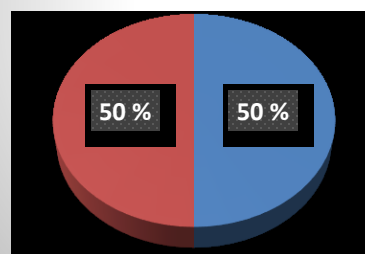
	Budapesti Gépészeti SzC Szily Kálmán Szakgimnáziuma Szakközépiskolája és Kollégiuma (Hungary)	Střední průmyslová škola chemická Pardu- bice (Czech Re- public)	The South Bohe- mian Company for Development of Human Resources (Czech Republic)	SrednjaŠkola “Du- goSelo” (Croatia)
Have students sel- ected their vocati- onal education or are they still in an orientation pro- cess?	Ongoing selection / orientation process	Already set their future studies for 4 years, they are in the middle of their studies	Vocational educa- tion has started	Ongoing selection / orientation process
Type of school	Technical school	VET, students of applied chemistry program (4 years, finished by state exam)	5 secondary techni- cal schools in South Bohemia *	Vocational school

* Vyšší odborná škola, Střední průmyslová škola automobilní a technická, České Budějovice, Skuherského 3, Vyšší odborná škola, střední škola, Centrum odborné přípravy Sezimovo Ústí, Budějovická 42, Střední průmyslová škola strojní a elektrotechnická, České Budějovice, Dukelská 13, Střední průmyslová škola a Vyšší odborná škola, Písek, Karla Čapka 402, SOŠE, COP Hluboká nad Vltavou, Zvolenovská 537

Average age of participating students:

Grade

DID STUDENTS USE
LESSON UNITS OR
LEISURE TIME FOR
CONSTRUCTION?



■ only leisure time
■ mixed / mostly
leisure time

Involvement in solar car construction

Who has provided the given rules and tasks to the students? How have you provided the rules? How have you discussed the tasks?

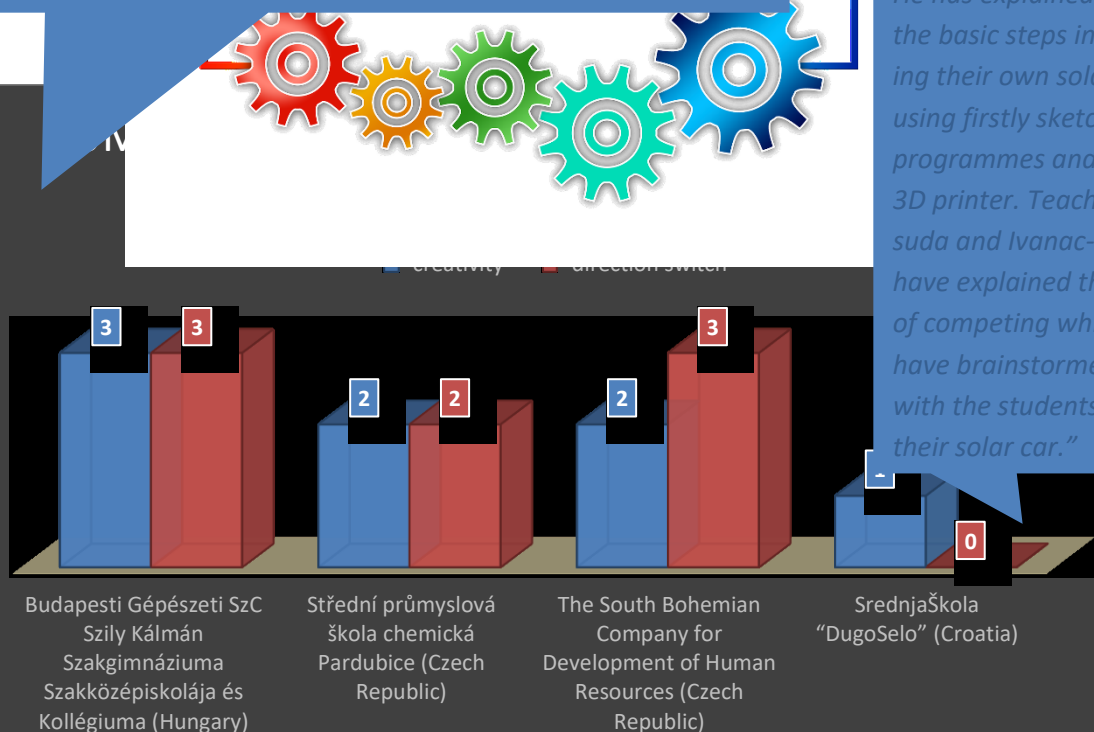
NUMBER OF SOLAR CAR MODELS CONSTRUCTED IN YOUR RESPONSIBILITY

Budapesti Gépészeti SzC Szily Kálmán Szakgimnáziuma Szakközépiskolája és Kollégiuma (Hungary)

"Teacher Attila Mészáros has worked with our students in all technical aspects of the competition. He has explained all of the basic steps in creating their own solar car by using firstly sketching programmes. He has explained the basics of competing while also have brainstormed ideas with the students about their solar car."

Srednjaškola "DugoSelo" (Croatia)

"Teacher Robert Peregrin has worked with our students in all technical aspects of the competition. He has explained all of the basic steps in creating their own solar car by using firstly sketching programmes and then a 3D printer. Teachers Posuda and Ivanac-Perutka have explained the basics of competing while also have brainstormed ideas with the students about their solar car."



Střední průmyslová škola chemická Pardubice (Czech Republic)

"First contact with rules and tasks the students got from physics teacher. Then they were steering by project manager and finally by another technical teacher. The rules and tasks were provided orally and via G-drive folder of tasks and rules. Some of the communication was done via emails as well. Their first task was to create the teams, name them and translate all provided material in national language. After the first contact they gathered several times to discuss and have workshop on creation of solar car models (3-5 times)."

*The South Bohemian Company for
Development of Human Resources
(Czech Republic)*

*"We got the rules from our partner
Solaris Förderzentrum für Jugend
und Umwelt gGmbH Sachsen and
we provide the rules to teachers.
The teachers presented rules to the
students. We communicated to-
gether via email and phone."*

How much time passed for the students between the first discussion of the tasks and the beginning of the blended mobility?

between 1 – 3 months

What is the average amount of time students have spent for the construction?

between 20 – more than 30 hours

Has anybody advised/supervised the students during the construction?

*Budapesti Gépészeti
SzC Szily Kálmán
Szakgimnáziuma
Szakközépiskolája és
Kollégiuma (Hungary)*

*"Yes, teacher Attila
Mészáros were su-
pervising them while
planning, construct-
ing and during the
tryout process."*

*Střední průmyslová škola che-
mická Pardubice (Czech Re-
public)*

*"Teacher specialists (physics,
technical subjects) - technical
advices and support. It was
during personal meetings with
the group and individually.
Also, some communication
have been done via emails."*

*The South Bohemian
Company for Devel-
opment of Human
Resources (Czech Re-
public)*

*"Sometimes the
teacher has but in
general the students
have provided the
construction of the
car by themselves."*

*SrednjaŠkola
"DugoSelo" (Cro-
atia)*

*"Yes, teacher Per-
eglin was present
during every step
of the solar car
planning and
construction, 3D
printing and test-
ing."*

Of solar cells, electric engine and gearbox were provided to all participating teams. Please describe which other materials your students have used for construction!

*The South Bohemian Company for Development of Human
Resources (Czech Republic)*

"3D printing, CDs, small material like screws, etc."

SrednjaŠkola "DugoSelo" (Croatia)

*"The Croatian team has participated in
the 'creativity' part of the competition.
For the construction we have addition-
ally used a blue filament for the 3D
printer and we have added an electri-
cal switch for the breaking of charge-
ment of the solar cells."*

Střední průmyslová škola chemická Pardubice (Czech Republic)

"Different teams used different materials. It was mainly during the blended mobility where they could have updated. They have used some of their own created objects for decoration (mini t-shirts). Very exciting methods was used with 3D pen. Carton, metal lego were also in the creation. Some students also used some wooden desc, sticks, wheel from the chair, plastic.

Creative 1: Merkur metal and rubber parts, wooden sticks, string, decoration items made from paper and textile, unicorn teddy bear duck tape, glue

Creative 2: Wooden board, wheel from chair and plastic wheels, duct tape, 3D pen material

Direction reverse 1: Lego parts, rubber and wooden wheels, metal axles, plastics and silicon, wooden sticks and parts

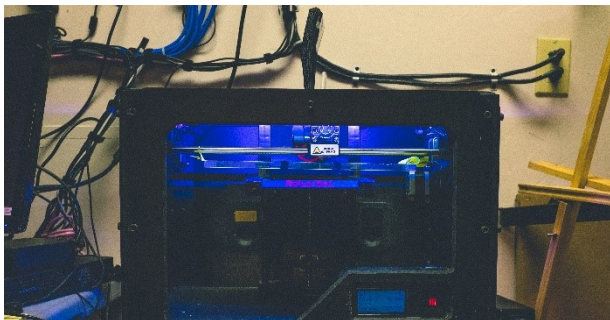
Direction reverse 2: Merkur metal and rubber parts, metal sticks, silicon"

Have students used special material / technologies for the construction?

- ✓ depron / polystyrene
- ✓ balsa
- ✓ 3D pen / printer / programming tool (Solid Edge)
- ✓ Metal lego constructions

Who has provided / ordered all needed construction material?

- ✓ host organization (solaris FZU)
- ✓ students
- ✓ school
- ✓ organization



Have you planned any budget for the solar car models? How much money was spent in total for all the construction material of such a solar car model?

Have students also used own (financial) resources for the construction?

<i>Budapesti Gépészeti SzC Szily Kálmán Szakgimnáziuma Szak-középiskolája és Kollégiuma (Hungary)</i>	We have planned to spend about 500€. The planned costs covered the needs of extra material.	No
<i>Střední průmyslová škola chemická Pardubice (Czech Republic)</i>	We planned to spend 100€. At the end we spend much less for some construction parts. The students brought most of the materials from home.	No
<i>The South Bohemian Company for Development of Human Resources (Czech Republic)</i>	We didn't use money for it	No
<i>SrednjaŠkola "DugoSelo" (Croatia)</i>	We haven't planned any budget for the solar car models because our school has two 3D printers as well as a supply of the blue filament for the printer.	No



mainly the students worked at school



very rarely the students work at home

Were the self-constructed solar car models ready for the competition
when you left the country for the blended mobility?
And which tasks were perhaps left?

Budapesti Gépészeti SzC Szily Kálmán
Szakgimnáziuma Szakközépiskolája és
Kollégiuma (Hungary)

"Yes, the model(s) were mostly ready"

Střední průmyslová škola chemická Pardubice (Czech Re-
public)

*"Some of our teams had to check the quality of the ride of
created Solar Cars during their mobility. It was great to
have test rides. It also showed that students had to review
everything. All of the created cars had to have some ad-
justments (mainly regarding technical). The transport it-
self also contributed to some malfunction of the cars."*

*"Students repetition on presentations have been practiced
during blended mobility."*

The South Bohemian Company for
Development of Human Resources
(Czech Republic)

"Yes, the model(s) were mostly ready"

*"Some of our cars do not move by
themselves in a category direction re-
verser."*

SrednjaŠkola "DugoSelo" (Croatia)

"Yes, the model(s) were mostly ready"

*"Some precise adjustments were needed to be done on the gear-
box."*

Creation of posters

“E-mobility in your own country” was given as main theme for an additional poster. Please describe briefly how your students have fulfilled this task?

Budapesti Gépészeti SzC Szily Kálmán Szakgimnáziuma
Szakközépiskolája és Kollégiuma (Hungary)

“Our students had to search for the application of solar energy all over the world on the Internet. Then they tried to specify the usage of solar energy by trying to find areas where they are used now. They collected photos and some data. After that they created 3 posters, which were corrected and edited by our desktop publisher students. In our printing office the finished posters were printed out.”

Střední průmyslová škola chemická Pardubice
(Czech Republic)

“Each student team (2 members in the team, in total 4 teams) have prepared posters with information and photos. Students were using different sources online in Czech and English language. Teachers have reviewed their work and provided constructive feedback. Adjustment has been made according to the comments. This process was repeated several times to reach quality posters.”

The South Bohemian Company for Development of Human Resources (Czech Republic)

“All teams of students fulfilled the task excellently. Each team made a different poster to this theme and presented information connecting this area from our region. The student also trained how to present the poster to the evaluators and gained new English skills.”

SrednjaŠkola “DugoŠelo” (Croatia)

“We have started with our history mentioning Nikola Tesla as the focal point of any improvements and discoveries in using electricity. We have tried to make a connection between Prometheus who has stolen fire from the gods and Tesla who has taken thunder from nature. Furthermore, we have mentioned a famous name in the Croatian car industry Mr. Rimac. He has made breaking discoveries and cars by using solar energy. Finally, we have mentioned the position of solar energy usage in Croatia researching how much of it is actually used. Gathering all of this information required a lot of investigation and reading of different articles, all of this was done by our students. Not to mention, our students watched a lot of documentaries and scientific shows about the given topic.”

additional idea: arranging an evaluation of the posters in advance

Part 3

Follow up and general feedback

Reflection process

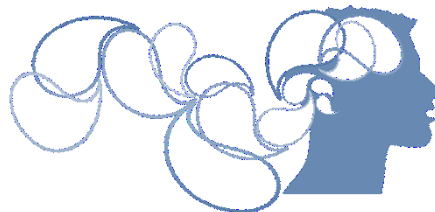
How did you reflect the blended mobility with your students? Are you planning any more follow up activities? What results do you see/await?

Budapesti Gépészeti SzC Szily Kálmán Szakgimnáziuma, Szakközépiskolája és Kollégiuma (Hungary)

"Our participating students together with Attila Mészáros fulfilled the dissemination, introducing their work in front of other students of our school. So the students who have participated have rounded their experience giving them the confidence needed to pursue their future affinities towards STEM areas with the possibility of empowering other students to participate in further competitions or projects. Attila Mészáros presented their work in front of other students of our school."

The South Bohemian Company for Development of Human Resources(Czech Republic)

"We would like to be involved in other Erasmus+ projects, we see a big possibility and opportunity for our organization and for the students as well in the field of blended mobility."



Střední průmyslová škola Chemická Pardubice(Czech Republic)

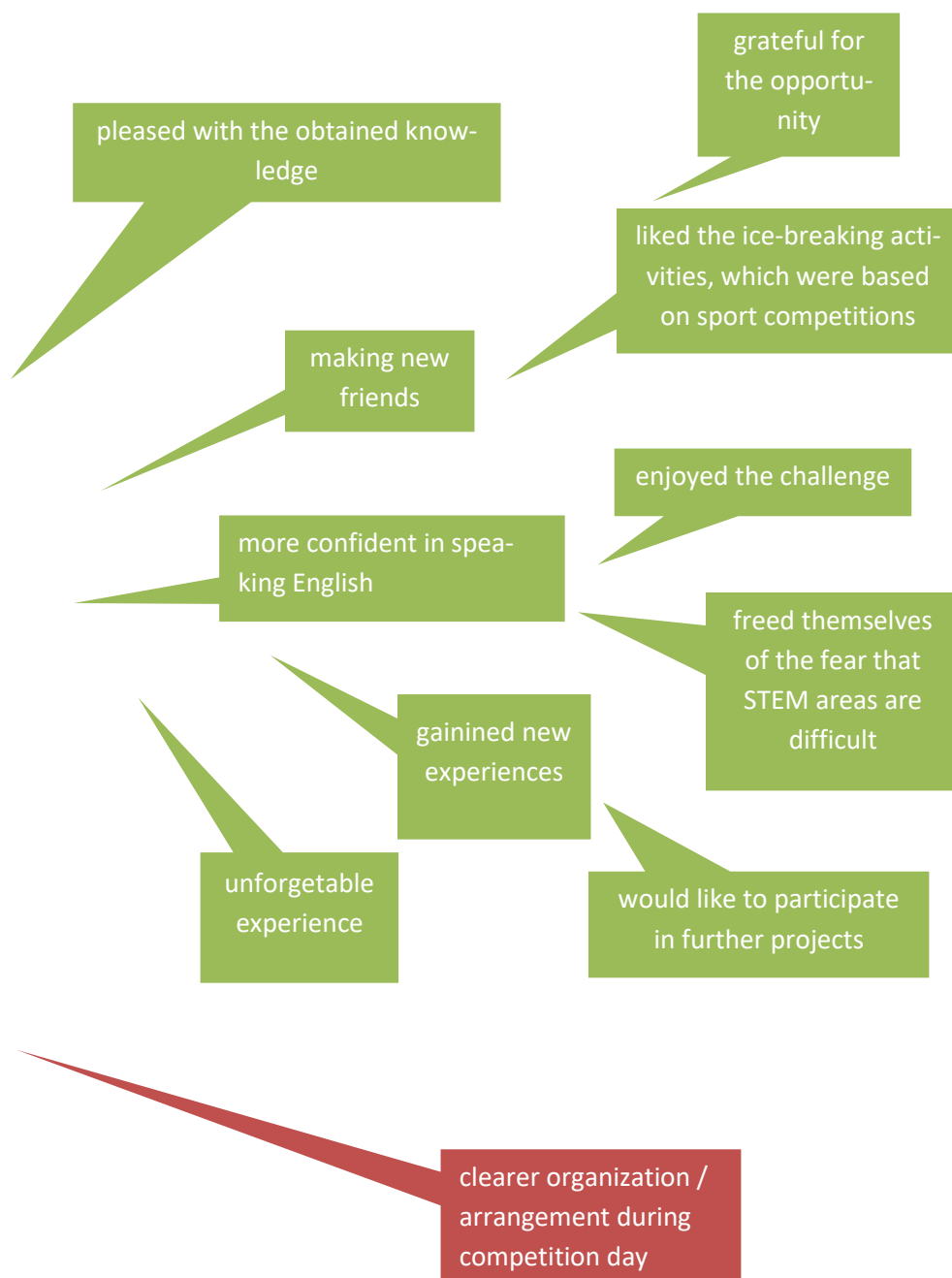
"With all students we had a meeting to review their feedback. Also, the students - participants had to fill out online questionnaire with indication of their developed skills, suggestions for further coming mobilities. From this questionnaire students also provided information for short articles in the school. The students also serve as a good example of how to create European network except classical KA1 Erasmus + activities. They disseminated their experiences during regular school dissemination activities."

Šrednjaskola "Dugo Selo" (Croatia)

"Firstly, we have introduced our teacher's council with the students results through a PowerPoint presentation which they have also presented on the last day of the blended mobility. We organized a meeting with the participated students asking them to provide their personal thoughts in front of other students of our school. So, the students have rounded their experience, giving them the confidence needed to pursue their future affinities towards STEM areas with the possibility of motivating other students to participate in further competitions or projects too."

Evaluation

What is the general feedback you got from the students?

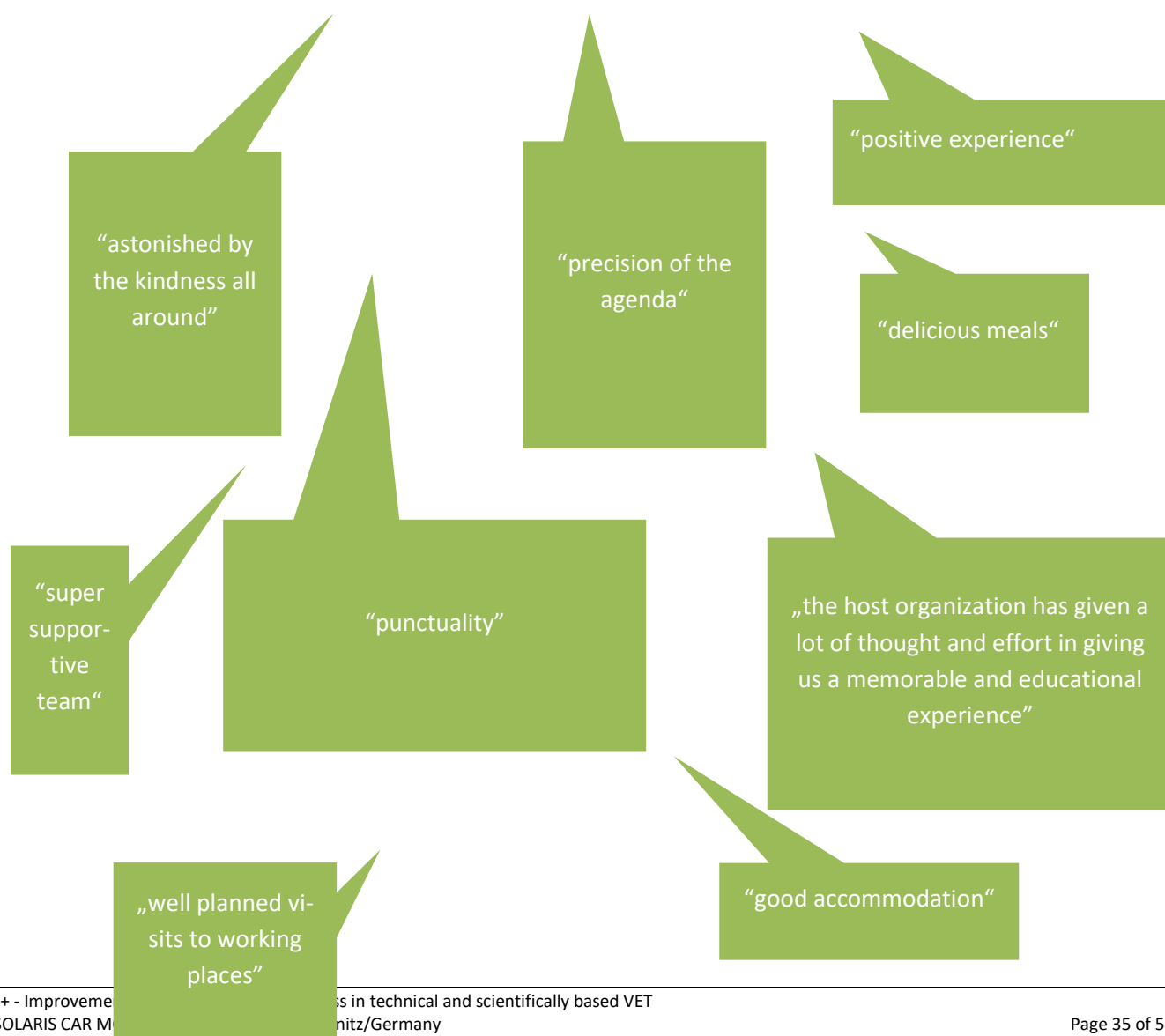


What is the
want to give to
German

solaris
Förderzentrum für Jugend
& Umwelt gGmbH Sachsen

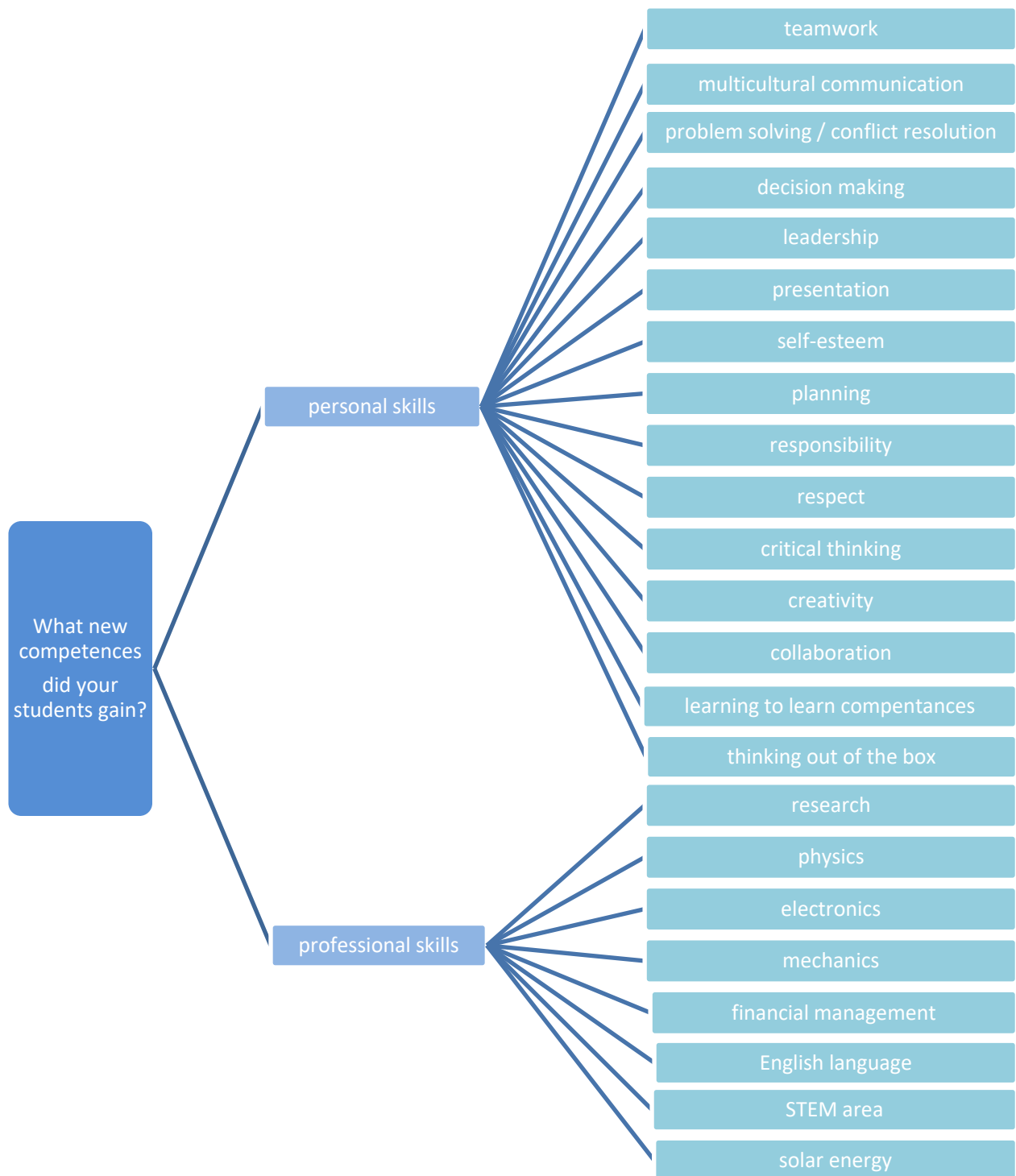


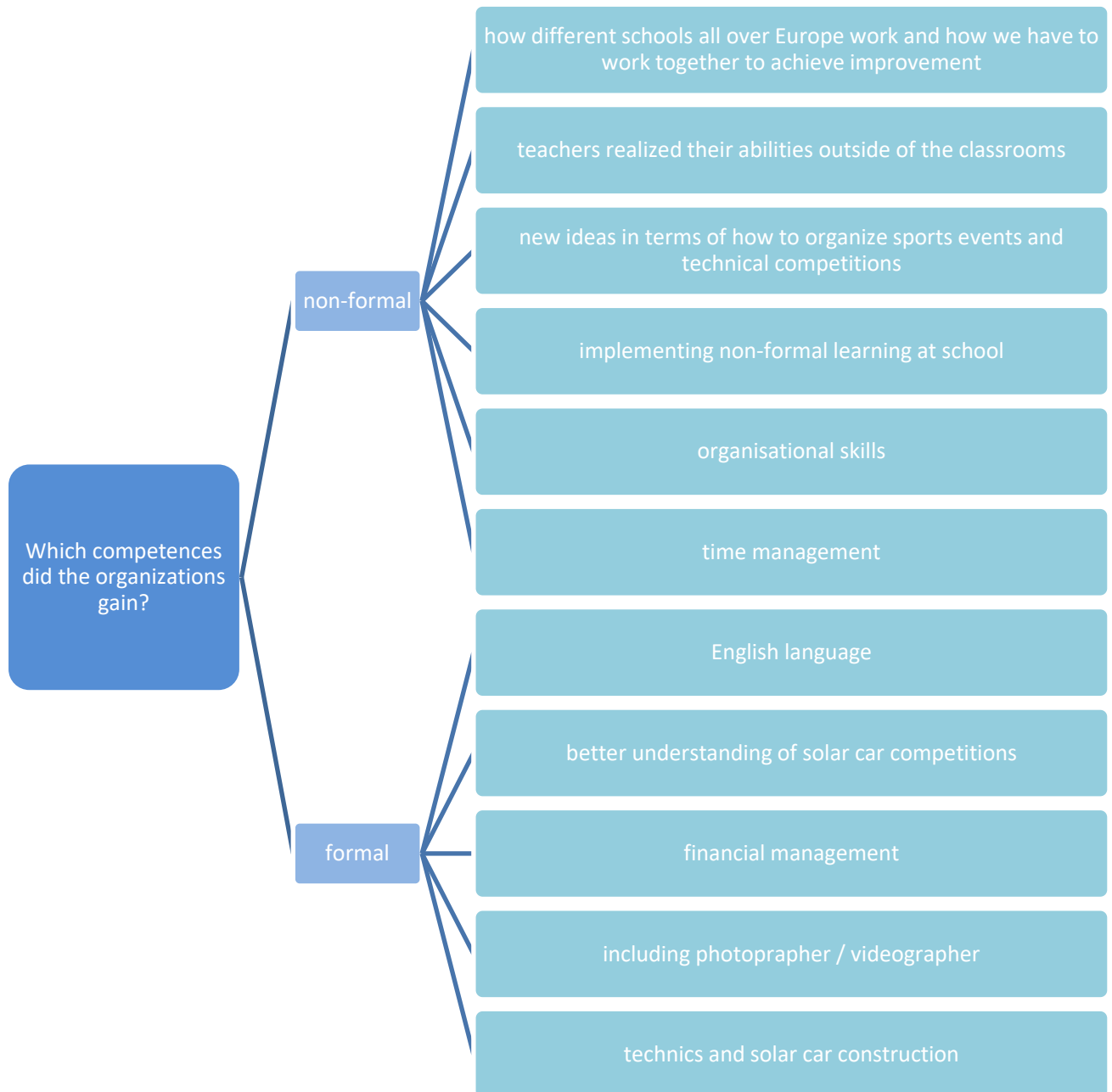
general feedback you
the responsible
organization?



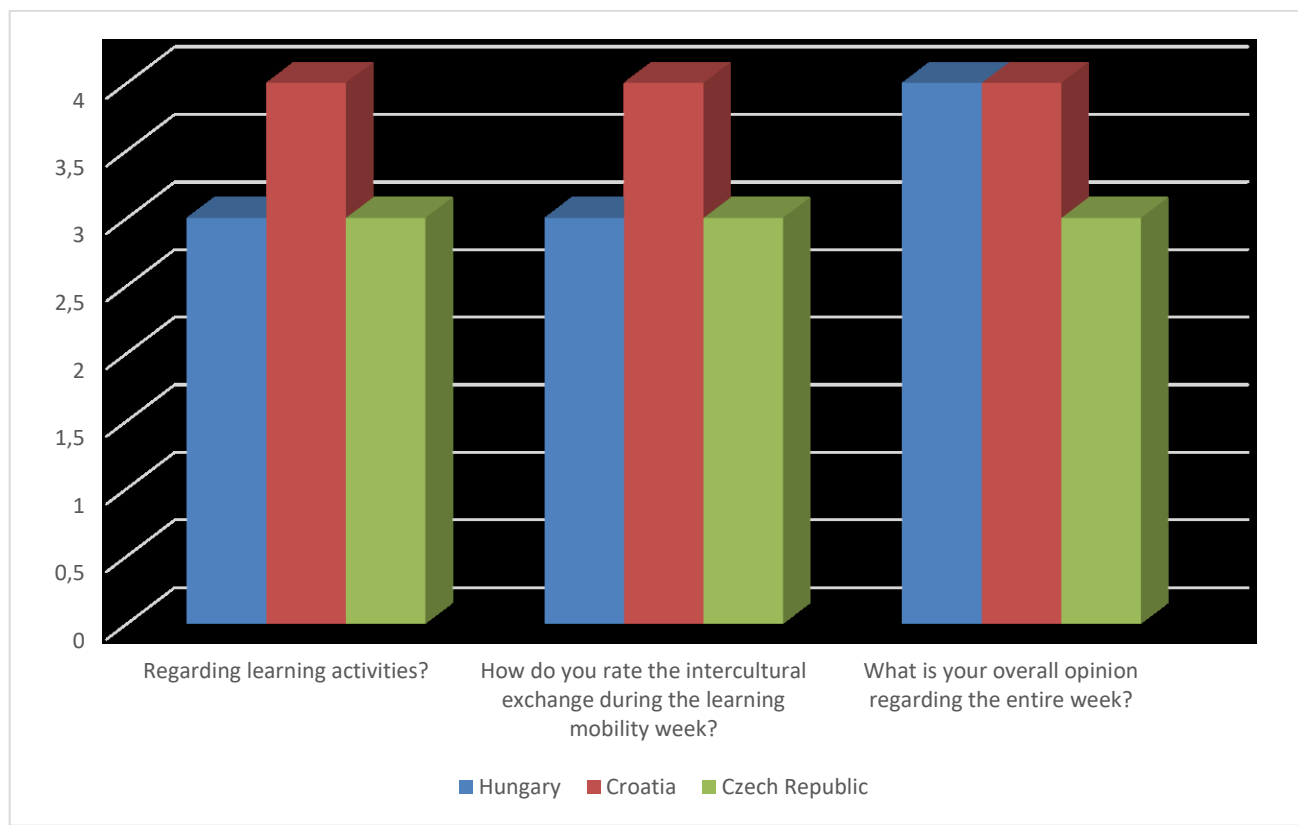
“organization of the fi-
nal competition”

Gained competences by participants



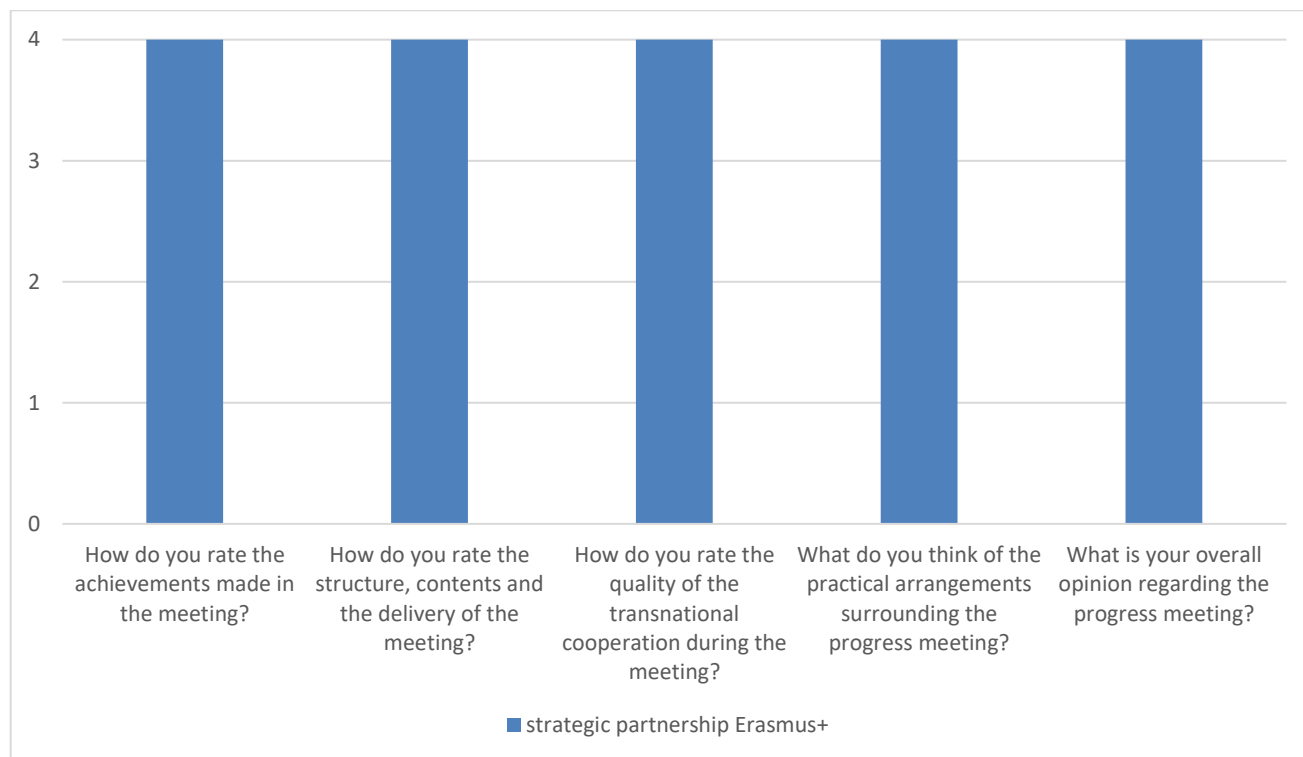


Evaluation student questionnaire CoCo+



grad of evaluation	4	3	2	1	0
meaning of evaluation	excellent	very good	good	satisfy	poor

Evaluation questionnaire CoCo+ progress meeting



grad of evaluation	4	3	2	1	0
meaning of evaluation	excellent	very good	good	satisfy	poor

Could you imagine to organize any local competition with your own organization in your region for the future? What could be the content of that competition? Are you probably interested to establish an own solar car model competition in your region?

We have already organized a nationally and internationally based competitions which have been well received and after gathering all of the information and experiences after the blended mobility we are very much considering the idea of organizing another competition. This new competition would be a 'Croatian solar car competition' through which we would mostly implement the ideas and organization of our German partners from this blended mobility.

The host organization has prepared certificates for each participating organization / school. How do you plan to use this certificates? Do you plan any presentation or ongoing activity with the created solar car models?

We plan to put the certificates into the CV's of the students. One of the examples is that a student who has participated in the blended mobility has used that certificate in her application for a national scholarship and will be receiving extra points because of it. We decided to use the solar car for further teaching in the sense that the students who have participated in the blended mobility pose as mentors to other students so that they can together make improvements on the solar car the Croatian team has used for the competition.

Střední průmyslová škola chemická Pardubice(Czech Republic)

It's the idea that students gain new competences by participation in blended mobility and the solar car model competition. What are examples of new individual competences your students have gained (personally, VET related, technically, scientifically, other)?

Here are several skills that our students have developed during the blended mobility:

Personal skills:

- Teamwork
- Multicultural Communication
- Problem Solving
- Decision Making
- Leadership
- Presentation
- Self-esteem
- Individual Work
- Planning
- Responsibility
- Conflict Resolution
- Respect
- Critical Thinking
- Collaboration
- Creativity

Professional skills:

- Research
- Physics
- Electronics

- Mechanics
- English Language

Financial skills

What are new competences partner organizations gained by collaboration in blended mobility C2?

One of the new things that our school have achieved among other international competition organisational skills. Also better understanding of Solar Car competition processing, financial management. Also in such international activities to include videographer/ photographer. A possible way how to reach the public since Solaris is in the youth sector and has different challenges to get young people involved in technical fields in comparison to technical schools.

Could you imagine to organize any local competition with your own organization in your region for the future? What could be the content of that competition? Are you probably interested to establish an own solar car model competition in your region?

Yes - definitely. As we are also organisers of national competition "Best Young Chemist" it was truly useful to see possible different ways in arranging technical competition. This passed blended mobility were inspirational in the way of public accessibility and workshops before the competition. As we have 4 different branches at the school that means students are already focused in some field. We would think about the organisation of competition dedicated to firefighters, security and law services, hairdressers and chemistry. We already established some for every branch but the biggest one is about chemistry. So we are not really planning to have our own Solar Car competition yet but it is a very good inspiration when we will have enthusiastic specialist which can attract more students even from different fields of study.

We have also introduced such idea to other schools in Pardubice related such topics.

The host organization has prepared certificates for each participating organization / school. How do you plan to use this certificates? Do you plan any presentation or ongoing activity with the created solar car models?

Students will include next to their CVs as annexes.

We have presented created Solar cars and posters during Erasmus+ Days 12.10.2018 at school for students.

All group have created a presentation that have been presented by participants and teacher and given during Erasmus+ days and planned to be presented during other school events.

We have an idea to prepare a corner in the school in showing the models.

The South Bohemian Company for Development of Human Resources(Czech Republic)

It's the idea that students gain new competences by participation in blended mobility and the solar car model competition. What are examples of new individual competences your students have gained (personally, VET related, technically, scientifically, other)?

Most of involved students were in such a competition and blended mobility for the first time. So they increased their social, language skills, technical competences in solar energy area, etc.

What are new competences partner organizations gained by collaboration in blended mobility C2?

New experience with other competition in solar car area connected with preparation and realization of the competition Solar car, technical information connected with construction of the car, new English competences and other information connected with setting programm for blended mobility and evaluation this kind of action.

Could you imagine to organize any local competition with your own organization in your region for the future? What could be the content of that competition? Are you probably interested to establish an own solar car model competition in your region?

As I have mentioned at the beginning we organize the technical competition Talents for companies. The students that were included in blended mobility in Chemnitz asked us if we would like to organize the Czech version of Solar Car in South Bohemia. It takes time to prepare this kind of competition and we will think about it. The students mentioned that they would like to take part in Chemnitz competition again on their own costs. Is it possible to take part the Solar Car competition in Chemnitz again?

The host organization has prepared certificates for each participating organization / school. How do you plan to use this certificates? Do you plan any presentation or ongoing activity with the created solar car models?

We would like to present the solar cars again in event Adventure with Technology is an event designed for children and their parents. The main goal is to encourage children to study technical subjects. The event has been designed in a very interesting and interactive way. We organize this event together with regional schools, universities, firms and other institutions. Thanks to high number of visitors, this event has become a periodic one and it is organized at the end of the school year in June.

We would like to present the teams and their Solar cars that competed in Chemnitz to other visitors in June 13, 2019.

SrednjaŠkola "DugoSelo" (Croatia)

It's the idea that students gain new competences by participation in blended mobility and the solar car model competition. What are examples of new individual competences your students have gained (personally, VET related, technically, scientifically, other)?

As we have previously mentioned our students are much more open to speaking in a foreign language with different individuals. Also, they have broken the stigma that STEM areas are difficult because they require a lot of thinking out of the box mixed with mathematical knowledge. Now, our students are not only eager to continue their education in different STEM areas but they have also shown others that it is actually fun and interesting putting a bit more effort and time into their education so that they open so much more educational and work possibilities than they think they have.

What are new competences partner organizations gained by collaboration in blended mobility C2?

We can say that international collaboration showed us how different schools all around Europe work. If we are to achieve a certain educational, scientific, economical or any other improvement it is imperative that we work and are able to function together. As much as the students have broken out of their mental shells the teachers have done so too in the sense of realizing their abilities outside of the classrooms and trying to improve their language skills. We have gained new ideas in terms of how to organize sport events which would be linked to technical competitions. We have gained new insight in enriching our workshops with our students. The organizing partner has shown us how to implement non-formal learning in interesting the students to pursue a scientific career.

Could you imagine to organize any local competition with your own organization in your region for the future? What could be the content of that competition? Are you probably interested to establish an own solar car model competition in your region?

We have already organized a nationally and internationally based competitions which have been well received and after gathering all of the information and experiences after the blended mobility we are very much considering the idea of organizing another competition. This new competition would be a 'Croatian solar car competition' through which we would mostly implement the ideas and organization of our German partners from this blended mobility.

The host organization has prepared certificates for each participating organization / school. How do you plan to use this certificates? Do you plan any presentation or ongoing activity with the created solar car models?

We plan to put the certificates into the CV's of the students. One of the examples is that a student who has participated in the blended mobility has used that certificate in her application for a national scholarship and will be receiving extra points because of it. We decided to use the solar car for further teaching in the sense that the students who have participated in the blended mobility pose as mentors to other students so that they can together make improvements on the solar car the Croatian team has used for the competition.

Annex 2

TECHNICAL REGULATIONS RACING CLASS SOLAR CARS - CREATIVE

Technical data building kit:

- 2 solar modules (ca. 0,5 V/4,6 A) **OR** an own solar module up to 512 cm² overall size
- 1 transmission kit with engine and holder (motor clasp)

Conditions of the competition:

- length x width x height of the model: max. 40 x 40 x 40 cm
- The solar module can be designed according to your own needs in the total size up to 512 cm².
- Caches and/or additional batteries for the drive are not allowed, but can be used for additional functions (electrical wiring must be verifiable).
- Driving distance: Proof of driving ability over a track length of approx. 10 m.
- Creative class applies to the solar cars.
- Originality, technical and artistic creations and the innovative design are equally valued as creative.
- Solar cars, which also comply with the regulations Solar Car Traditional or Solar Car with drive direction reverser, are eligible to start in these racing classes.

Vehicle construction and poster:

- Creating and submitting of a poster in the format A2 on the topics ecology and mobility allows you to participate in the “Best Poster” category.
- Free choice of materials and of design for solar cars and posters in format A2.
- On both sides of the solar car at least 5 x 5 cm large and smooth surfaces must be provided, which are suitable for sticking the two start numbers after the acceptance of the model. On the below right side of the poster a 5 x 5 cm large square for the start number has to be provided as well.
- The model cars and posters will be evaluated together by an independent jury of experts.
- The solar cars will be evaluated on site and on the competition day.
- The evaluation is based on the following scheme:
 - category, description, idea
 - concept: Is the construction of the model environment-friendly, innovative or particularly energy-efficient? Are renewable resources used?
 - quality craftsmanship: care of execution, professionalism of appearance, installation of solar cells, cables or chassis
 - creativity: design, clarity, ideas
 - poster: overall impression and comprehensibility
- How can the students explain their project? How is the information processed? Can the students talk about their vehicle and their poster?

TECHNICAL REGULATIONS RACING CLASS SOLAR CARS WITH DRIVE DIRECTION REVERSER

Technical data building kit:

- solar modules (ca. 0,5 V) **OR** an own solar module up to 350 cm² overall size
- transmission kit with engine and holder (motor clasp)
- Gold-/Green-Cap 5,5 V with a capacity of 0,1 F

Conditions of the competition:

- length x width x height of the model: max. 40 x 20 x 30 cm
- Definition of height of changeover: from roadway max. 20 cm
- Ground clearance: Guide pin 5 mm, car min. 20 mm
- The total area of the solar modules used may not exceed 350 cm².
- Free choice of solar cells in the assignment and switching of the solar modules is possible.
- A modification of the vehicles is not allowed after acceptance (except once the switching of the modules)
- As additional energy storage for the support of the drive, the capacitor (Gold-/Green-Cap 5,5 V with a capacity of 0,1 F) from the building kit is allowed.
- Capacitors for controlling an electrical switch may be installed on a small scale in the vehicle. The total capacitance of the built-in regulating capacitors must not exceed a value of 500 µF, regardless of the type of interconnection. The single capacitors must again not exceed a capacitance of 100 µF. It is explicitly pointed out that the regulating capacitors must not be used to store or feed the electric drive. The use of regulating capacitors must be indicated during acceptance and the interconnection of the capacitors must be pointed out.
- Free choice of drive direction reverser.
- All drive components (engine, gearbox, wheels, etc.) are freely selectable and may be adapted to the conditions (for example, by changing the gear ratio or the wheel diameter) before a run.
- After acceptance, only the interconnection of the modules may be changed.
- Number and type of engines are freely selectable (max 12 € per engine, original proof of purchase obligation).
- The vehicle must be designed in such a way that the electrical system can be inspected easily at any time during inspections.

Vehicle construction and poster:

- Creating and submitting of a poster in the format A2 on the topics ecology and mobility allows you to participate in the “Best Poster” category.
- Renewable raw materials or recyclable material for chassis and molded parts must be provided for the design of the solar cars and posters in format A2 (drive components are free).
- On the top of the solar car at least 5 x 5 cm large and smooth surface must be provided, which is suitable for sticking the start number after the acceptance of the model. On the below right side of the poster a 5 x 5 cm large square for the start number has to be provided as well.
- The model cars and posters will be evaluated together by an independent jury of experts.

- Lane length (about 10 m) over a straight line, with a guide rail (inside dimension: 11 mm high and wide, external dimensions: 15 mm high and wide) on a table with end stops.
- The tracking must be done via one or more centrally placed guide pins on the solar car, the insertion of the drive wheels in the guide rails for tracking is not allowed.
- Runs with tunnel passage (about 1 m long) and at least 3 turns, the length of the route can be determined separately on the day of the competition by the competition management.
- Qualifying heat and qualification according to time, final is performed as a k.o.-competition.

REGULATIONS RACING CLASS SOLAR BOATS

SOLAR BOAT WITH AIRPROPELLER DRIVE

- Kit - technical data:
- 1 solar module (approx. 0.5 V/4.6 A)
 - 1 motor (e.g. RF 270)
 - 1 Bracket (motor clasp)
 - 1 airscrew
 - length of the model: min. 40 cm to max. 50 cm
 - width of the model: min. 15 cm to max. 30 cm
 - height of the model: max. 30 cm

SOLAR BOAT WITH PROPELLER DRIVE

- Kit - technical data:
- 1 solar module (approx. 0.5 V/4.6 A)
 - 1 motor (e.g. RF 270)
 - 1 Bracket (motor clasp)
 - 1 propeller
 - 1 stern tube
 - length of the model: min. 40 cm to max. 50 cm
 - width of the model: min. 15 cm to max. 30 cm
 - height of the model: max. 30 cm

SOLAR BOAT WITH FREE DRIVE/CREATIVE

- Kit - technical data:
- 1 solar module (approx. 0.5 V/4.6 A)
 - 1 motor (e.g. RF 270)
 - 1 Bracket (motor clasp)
 - length of the model: max. 50 cm
 - width of the model: max. 50 cm
 - height of the model: max. 50 cm

Competition conditions:

- Teams and individual starters in grades 3 to 6 (2-3 students in teams).
- Exclusive use of the provided solar module and motor.
- Solar modules of the same size but of different design from previous years are permitted.
- The propeller and the airpropeller may be changed or modified according to your own ideas.
become.
- Creating a poster in A2 format (Topic: Why is my boat progressing?).
- Cache and/or additional batteries are not required for propulsion support.
allowed.
- Free choice of material/free choice of design for the solar boats and posters in A2 format.
- Distance over water, turn around and back. Start and finish as well as the length of the route will be displayed.
on the day of the competition as determined by the competition management.
- Straight ahead driving must be ensured by the installation of control equipment. During the race
a correction aid of the direction stands for the participants to the side - each employment has 2 penalty seconds
as a result.
- A smooth surface at least 5 x 5 cm in size must be provided on a clearly visible part of the solar boat, which is suitable for sticking on the start numbers after acceptance.
Likewise, a space of 5 x 5 cm must be provided on the poster at the bottom right for the start number.
- The preliminary race will be by time, the final race/final race will be a knockout competition.
- Turning has to be done exclusively by team participants or other young people.
- Defects during the race must be repaired within 2 minutes.

The places 1-3 qualify for the state competition, the solaris CUP Saxony. The announcement of the Saxony state competition (www.solaris-fzu.de/solaris-Cup) must be observed.

Vehicle construction and posters:

- The boats and posters will be evaluated together by an independent jury of experts.
- As creative, originality, technical and artistic creations and the innovative construction is equally valued.
- The evaluation of the boats will take place on site and on the day of the competition.
- Free choice of material/free choice of design for solar boats and posters in A2 format
- The design of the poster is included in the evaluation of creativity.
- How can the students explain their project? How is the information prepared? Can be used with students discuss their vehicle and posters?

