

## Activity Report – BRIGHT International Summer School (19<sup>th</sup> – 30<sup>th</sup> July 2021)

- Extended version -

In the frame of the **ERASMUS KA 226 BRIGHT Project**, the Technical University of Cluj-Napoca together with its partners of the BRIGHT project consortium hosted an international summer school in the field of 3D printing for medical applications between **19<sup>th</sup> and 30<sup>th</sup> July 2021**.

The poster is a promotional graphic for the BRIGHT International Summer School. It features a central image of a person wearing a VR headset, interacting with a digital interface that displays a DNA helix and various data points. The background is a light blue and white geometric design with triangles. At the top left is the BRIGHT logo, which includes a gear icon and the text 'BRIGHT' and 'Boosting the scientific excellence and innovation capacity of 3D printing methods in pandemic period'. At the top right is the logo of the Technical University of Cluj-Napoca, Romania. The main title 'BRIGHT International Summer School on: 3D printing for medical applications' is prominently displayed in the center. Below the title, the dates '19 - 30 JULY 2021' are shown in a dark blue triangle. To the left of the central image, there is a red triangle with the text 'More details' and a cursor icon pointing to the website 'www.bright-project.eu'. Below the website, it says 'Registration until 1<sup>st</sup> of July 2021'. To the right of the central image, there is a blue triangle with the text 'WHO can apply' followed by 'Bachelor students (BSc)', 'Master students (MSc)', and 'PhD students'. Below this, a section titled 'SPECIALIZATIONS:' lists several fields: 'Manufacturing Engineering', 'Mechatronics & Robotics', 'Mechanical & Bio-Mechanical Engineering', 'Science of Materials', 'Physics & Chemistry', and 'Medicine & Pharmacy'.

**BRIGHT**  
Boosting the scientific excellence and innovation  
capacity of 3D printing methods in pandemic period

**TECHNICAL UNIVERSITY**  
OF CLUJ-NAPOCA  
ROMANIA

BRIGHT International Summer School on:  
**3D printing**  
for medical applications

19 - 30  
JULY  
2021

More details

[www.bright-project.eu](http://www.bright-project.eu)

Registration until 1<sup>st</sup> of July 2021

**WHO can apply**

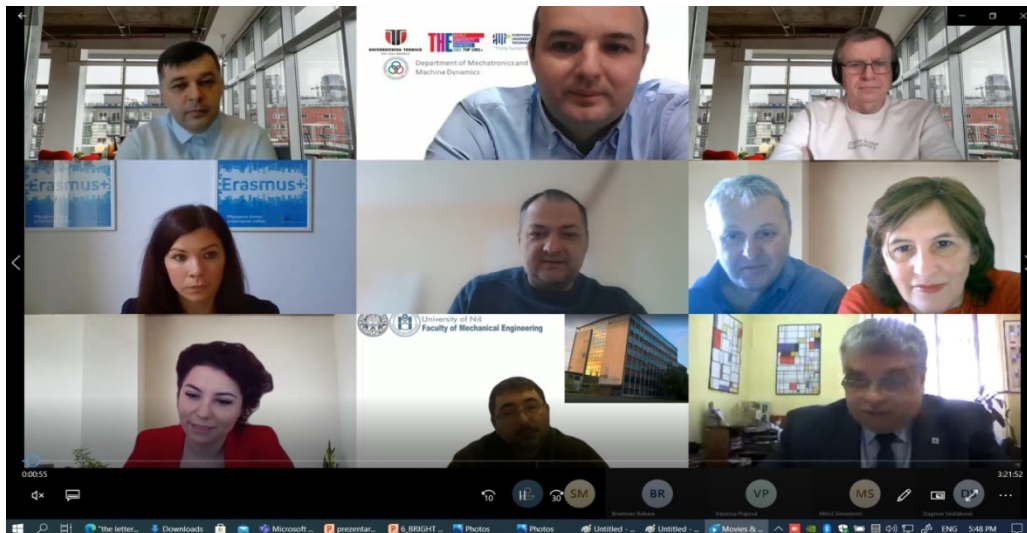
Bachelor students (BSc)  
Master students (MSc)  
PhD students

**SPECIALIZATIONS:**

- Manufacturing Engineering
- Mechatronics & Robotics
- Mechanical & Bio-Mechanical Engineering
- Science of Materials
- Physics & Chemistry
- Medicine & Pharmacy

A total number of 330 attendees from more than 20 European countries registered for participating to this event which, even if this was held online, was able to establish a sufficiently strong connection with long-term positive impact not only between students and teachers but also between university institutions and well-known European companies involved in the field of 3D printing, national and European development agencies, as well as public institutions of local importance (Cluj-Napoca City Hall).

The elevated scientific level of the summer school was emphasized by several invited speakers who participated in the opening ceremony: Prof.Dr.Eng. Dan Mândru (vice-rector in charge of international relations and official representative of T.U. Cluj-Napoca), Prof.Dr.Eng. Corina Bîrleanu (dean of the Faculty of Industrial Engineering, Robotics and Production Management), and Assoc.Prof.Dr.Eng. Adrian Trif (head of the Department of Manufacturing Engineering).

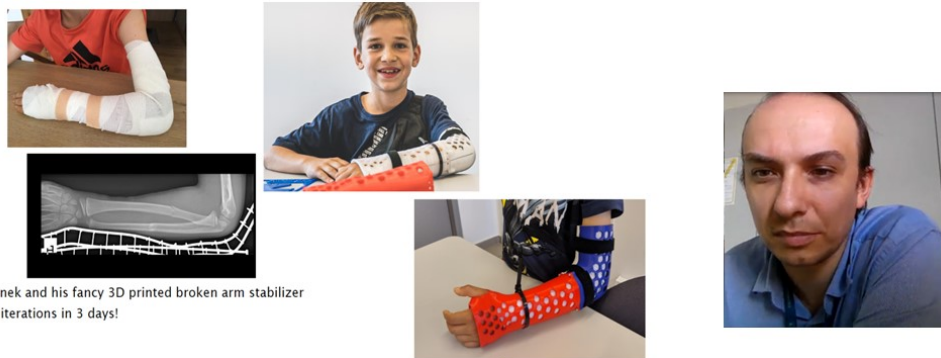


The message addressed by Mr. Emil Boc (mayor of Cluj-Napoca) to the participants emphasized that young people are characterized by an inexhaustible source of creativity which enables them to face any challenge of the labour market. This message provided a great motivation to the attendees who decided to share their knowledge and expertise in the frame of an educational project focused on professional training in a knowledge-based society.

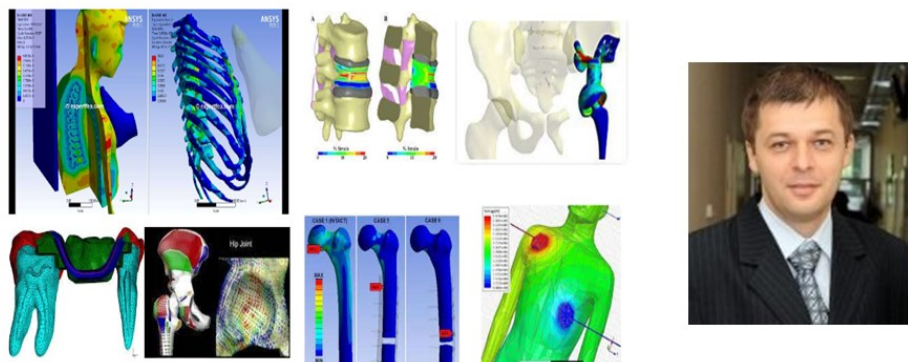


Many teachers from T.U. Cluj-Napoca as well as from other Romanian and foreign partner universities gave lectures to the students enrolled in the summer school. These lectures provided the speakers with the opportunity of sharing their expertise in various medical applications of engineering:

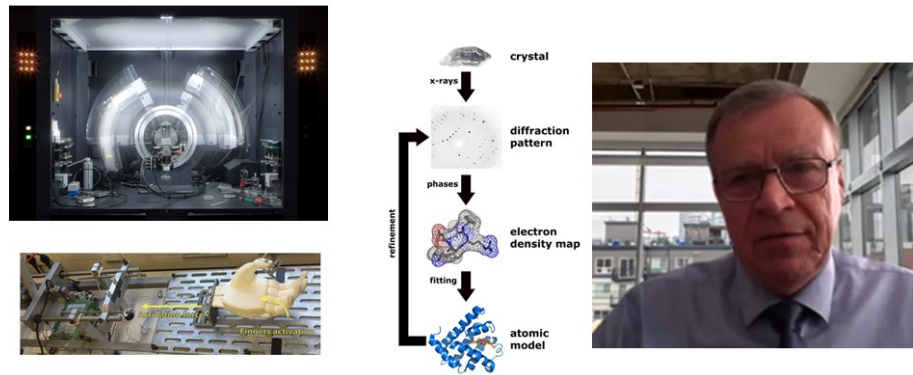
- Computer-aided design of medical devices (Assoc.Prof.Dr.Eng. Filip Gorski, T.U. Poznan, Poland)
- Validation of the design solutions by finite element analysis (Assoc.Prof.Dr.Eng. Răzvan Păcurar and Assoc.Prof.Dr.Eng. Sorin Comșa, T.U. Cluj-Napoca, Romania)
- 3D printing of medical devices and their mechanical testing (Prof.Dr.Eng. Nicolae Bâlc, Prof.Dr.Eng. Petru Berce, and Assoc.Prof.Dr.Eng. Răzvan Păcurar, T.U. Cluj-Napoca, Romania; Prof.Dr.Eng. Remigiusz Labudzki and prof. Prof.Dr.Eng. Radolsaw Wichniarek, T.U. Poznan, Poland; Assoc.Prof.Dr.Eng. Aleksandar Miltenovic, University of Niš, Serbia)
- Validation and standardization of medical devices (associate prof.dr.eng. Sven Maricic, Juraj Dobrila University, Croatia).



**CAD module held by Prof. Filip Gorski, Univ of Poznan, PL**



**CAE module held by Associate Prof. Razvan Pacurar, TUCN, RO**



**Materials Science and Strength of Materials module held by Prof. Remigiusz Labudski, Univ of Poznan, PL**

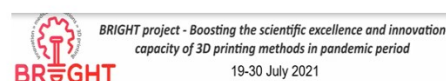


**Medical engineering and tests module held by Prof. Sven Maricic, Univ. of Juraj Dobrila, Istria, HR**

The students thus became aware of the fact that a multitude of technical and medical aspects should be considered when devising new products or procedures.

Some additional topics of importance for the medical applications of 3D printing were also covered by lectures given in the frame of the BRIGHT summer school:

- Elaboration of intelligent materials and computational tools used to predict the mechanical properties of such materials (Prof.Dr.Eng. Cătălin Popa and Prof.Dr.Eng. Mircea Dudescu, T.U. Cluj-Napoca, Romania)
- Topological optimization in computer-aided design (Prof.Dr.Eng. Nikola Korunovic, University of Niš, Serbia)
- Optimization of 3D printing and control processes (Prof.Dr.Eng. Nikola Vitkovic, University of Niš, Serbia)
- Reverse engineering techniques (Senior Lecturer Dr.Eng. Ștefan Bodi, T.U. Cluj-Napoca, Romania)
- Flexible manufacturing systems and robotic systems for medical applications (Prof.Dr.Eng. Doina Pîslă, T.U. Cluj-Napoca, Romania; Prof.Dr.Eng. Peter Kostal, S.T.U. Bratislava, Slovakia)
- SEM/TEM analyses (Assoc.Prof.Dr.Eng. Diana Băilă, Polytechnic University of Bucharest, Romania; Eng. Maria Ratajczak, T.U. Poznan, Poland).



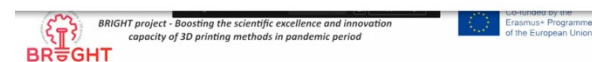
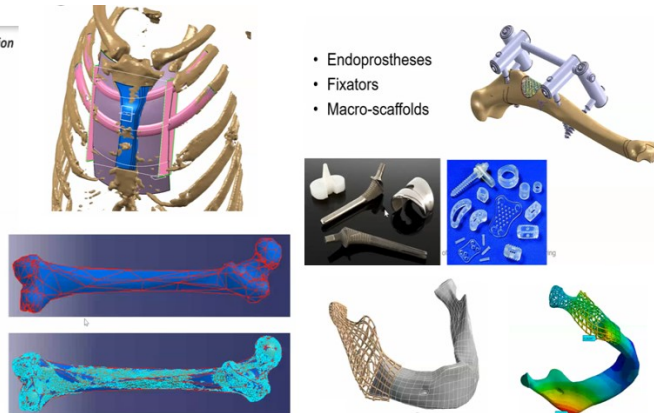
## Biomedical applications and challenges

- Personalised approach -

Prof. Dr Miroslav Trajanović  
University of Niš, Faculty of Mechanical Engineering

28 July 2021

28.7.2021. BIM1017 Virtual human osteoarticular system and its application in preclinical and clinical practice

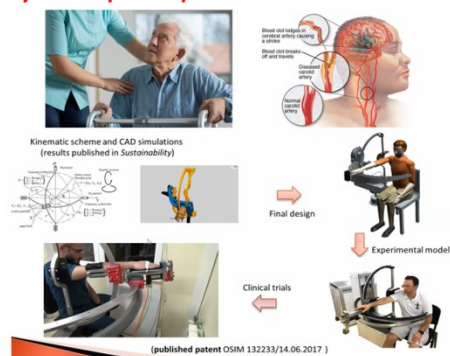


## Innovative Robots for Medical Applications: New Trends and Challenges

Prof. Doina PISLA, PhD  
Technical University of Cluj-Napoca, Romania  
28.07.2021



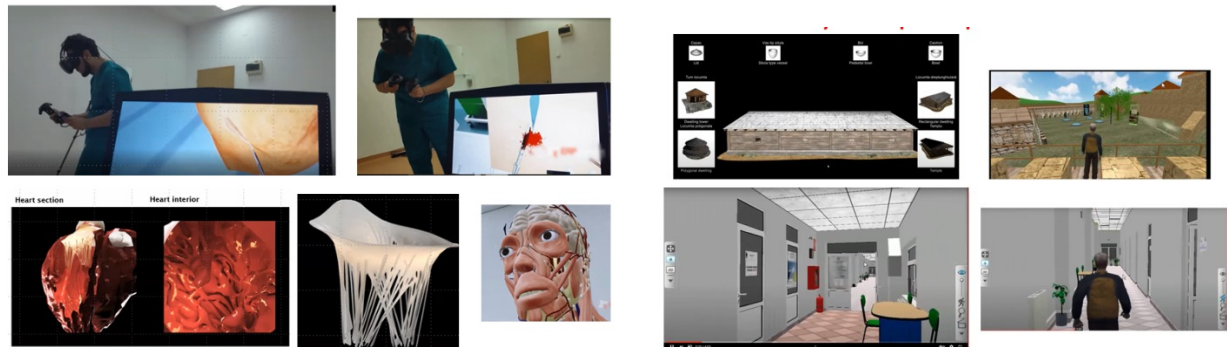
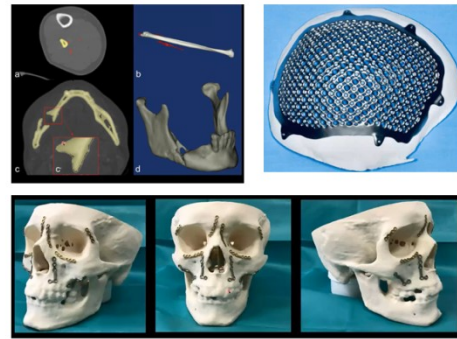
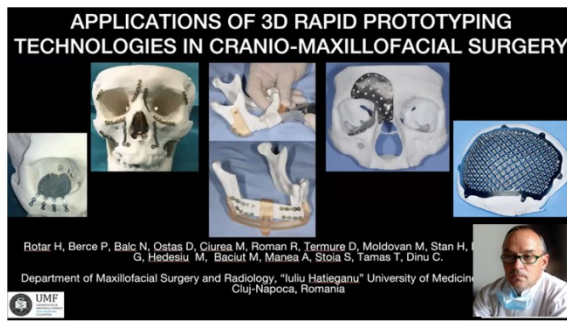
This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



An interesting perspective of a maxillofacial surgeon was presented by Assoc.Prof.Dr.Med. Alexandru-Horațiu Rotaru, "Iuliu Hațieganu" University of Medicine and Pharmacy of Cluj-Napoca, Romania. In his lecture, the speaker approached the following topics:

- Importance of developing new 3D printing procedures with medical applications
- Importance of 3D bioprinting

Regarding methods of medical training based on Virtual Reality and Augmented Reality, this topic has been approached in the presentation given by Prof.Dr.Eng. Milos Manic, Virginia Commonwealth University, USA, and by Assoc.Prof.Dr.Eng. Dan Sergiu Stan together with his co-workers from T.U. Cluj-Napoca, Romania.

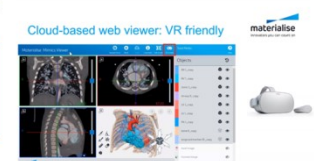
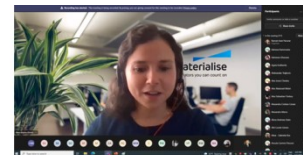


Among other topics, the future research to be performed in the frame of the BRIGHT project will be focused on developing applications of Virtual Reality and Augmented Reality for medical training and 3D printing of medical devices in 2022.

Several companies specialized in 3D printing and/or 3D bioprinting presented their new products as well as the latest developments in these fields: Materialise (Belgium), EnvisionTEC (Germany), 3D Systems (Germany), SPEE3D (Germany), Stratasys (France), NU Technologies (Romania), Symme3D (Romania), and Omni3D (Poland). Three companies involved in the development of software solutions for medical applications also presented their achievements in the fields of computer-aided design, computer-aided manufacturing, virtual reality, and augmented reality: CADWORKS (Romania), Solfin 3D (Serbia), and Bizzcom (Slovakia). All these partners expressed their availability to cooperate in the future with students and teachers participating in the BRIGHT summer school (preparation of graduation/MSc/PhD theses, collaboration in Horizon joint-research projects, hosting students/researchers, etc.).



Carlos Carvalho– envisionTEC (Gladbeck, DE)

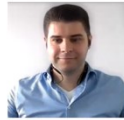


Diana Skopina, Materialise (Leuven, Belgium)

**SLM SOLUTIONS**

## Selective Laser Melting for Qualified Serial Production of Medical Devices

Philip Oris, Business Development Director Healthcare, SLM Solutions  
 Robin Bappert, Application Engineer Healthcare, SLM Solutions  
 philip.oris@slm-solutions.com robin.bappert@slm-solutions.com



Robin Bappert, SLM Solutions GmbH (Lubeck, DE)

**SPEED3D**

HIGH SPEED, LOW COST 3D METAL PRINTING

Materials (powders):  
 - Titanium  
 - Inconel  
 - Stainless Steel  
 - Aluminum  
 - Copper  
 - Silver

Advantages with 2 part bed:  
 - Short lead times  
 - Low cost  
 - High quality  
 - No post processing

Compressed heated air:  
 - 1. High pressure  
 - 2. High temperature  
 - 3. High speed

Powerful lighting module:  
 - 1. High power  
 - 2. High speed  
 - 3. High quality



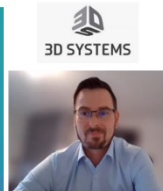
Stefan Ritt, Speed3D (Lubeck, DE)

**3D SYSTEMS**

## 3D printing in healthcare applications

Stefan Kapp  
 Business Development Manager EMEA, Healthcare  
 Stefan.Kapp@3dsystems.com

We are the leaders in enabling additive manufacturing solutions for applications in growing markets that demand high reliability products.



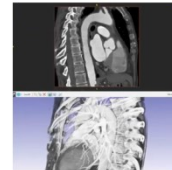
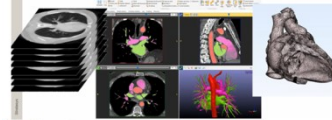
Stefan Kapp, 3D systems company (Baden, Germany)

**Bright Summer School**

Arnaud Toutain  
 Healthcare Senior Manager EMEA  
**Stratasys**

POC 3D Printing Workflow: Segmentation

How is it actually being done?



**symme3D**

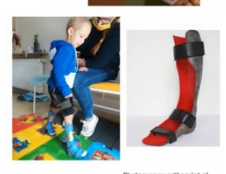
Calin Brandabur – Symme 3D (Timisoara, RO)



Calin Brandabur – Symme 3D (Timisoara, RO)

**OMNI3D**

Krzysztof Kardach, Omni3D (Poznan, PL)



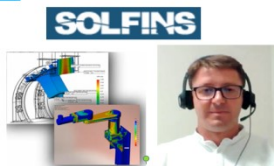
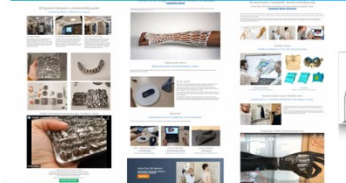
Krzysztof Kardach, Omni3D (Poznan, PL)

**BRIGHT International Summer School 2021**

**SOLFINS**

## Affordable Professional 3D Solutions for Medical Applications

Miloš Momirović & Mladen Božićević  
 Solfins 3D Company  
 Belgrade 2021

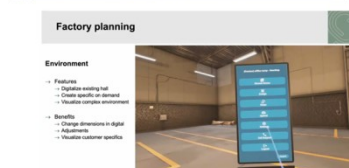


Milos Momirovic (Belgrade, SRB)

**bizz.com**

## Factory Digital Transformation

MORE THAN TECHNOLOGY



Branislav Rabara (BIZZCOM, SK)

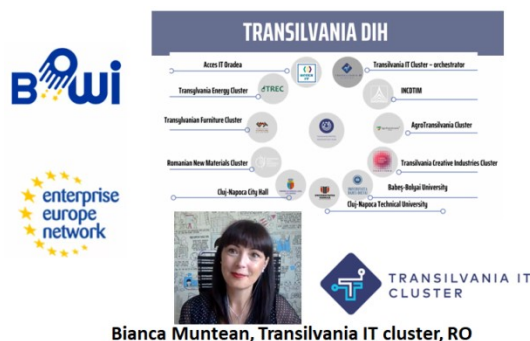
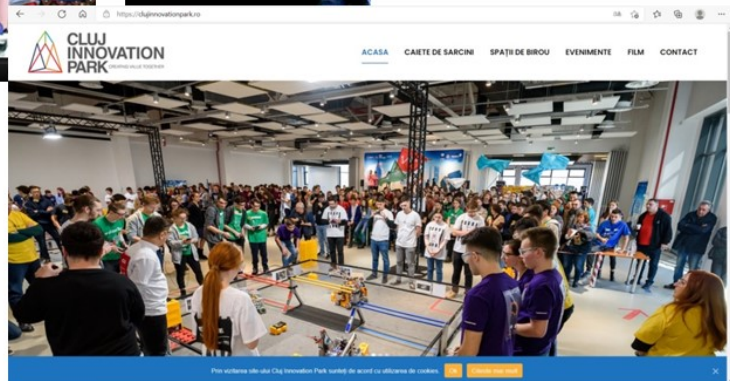


Claudiu Birlogeanu (Craiova, RO)

The North-West Regional Development Agency (Cluj-Napoca, Romania), Transilvania IT Cluster (Cluj-Napoca, Romania), and the representatives of Cluj-Napoca City Hall were also actively involved in the plenary sessions of the summer school. These partners provided valuable information on the opportunities of accessing funds or creating start-ups.



Ms. Oana Buzatu and  
Ms. Emilia Botezan,  
City Hall institution,  
Cluj-Napoca, RO



Bianca Muntean, Transilvania IT cluster, RO



The participants in the summer school had the occasion to discuss with the representatives of two important publishing houses (MDPI, Switzerland, and IntechOpen, UK) about the possibilities of disseminating their scientific and teaching results. IntechOpen also expressed its interest in publishing a

monograph/coursebook on 3D printing under the supervision of Assoc.Prof.Dr.Eng. Răzvan Păcurar (coordinator of the ERASMUS KA225 BRIGHT project) as a chief-editor.



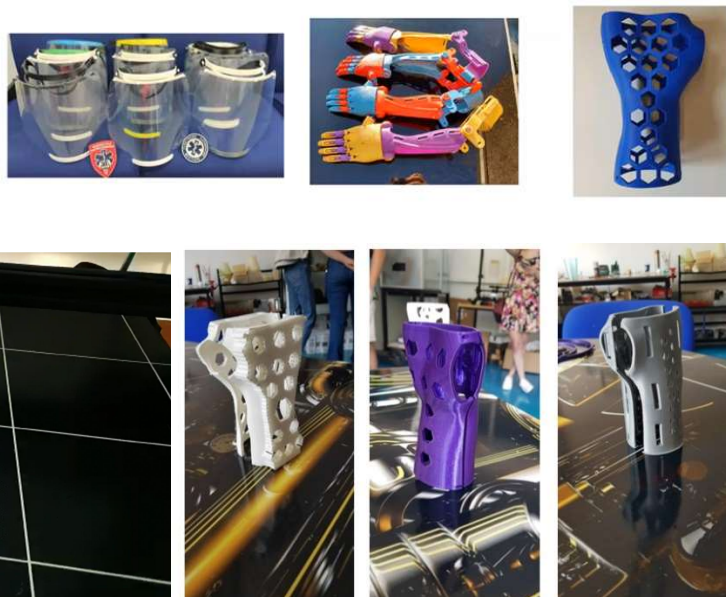
Besides the large amount of technical and scientific information provided by lecturers, one should also emphasize the active participation of students and teachers in seminars and laboratory meetings. The students were assigned laboratory works consisting in the following tasks:

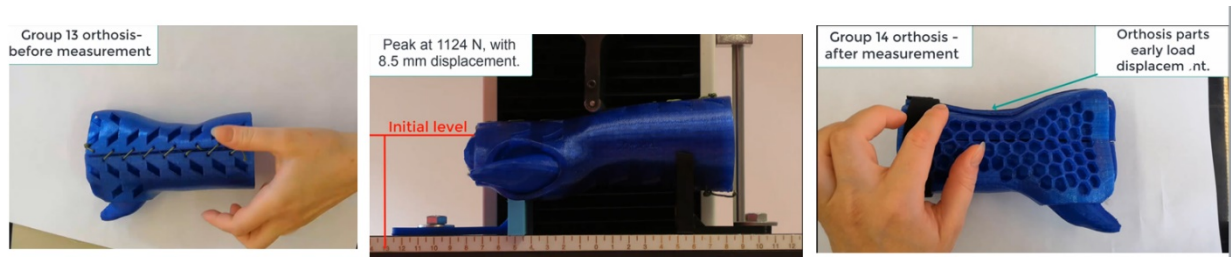
- Improving the design of a medical device (face shield, wrist orthosis, or hand prosthesis)
- Validation and optimization of the improved design by finite element analysis
- 3D printing of the redesigned medical device in the laboratories of T.U. Cluj-Napoca (Romania) and the laboratories of BRIGHT partners' consortium
- Mechanical testing of the 3D-printed medical device in the laboratories of T.U. Poznan (Poland) and the laboratories of other BRIGHT partners' consortium
- Presentation of the laboratory work in a plenary session of the summer school.

After finishing each task of their laboratory work, the students received feedbacks from experts involved in the BRIGHT consortium.

## PRODUCTS

- 1) face shield
- 2) mechanical hand prosthesis
- 3) openwork wrist hand orthosis

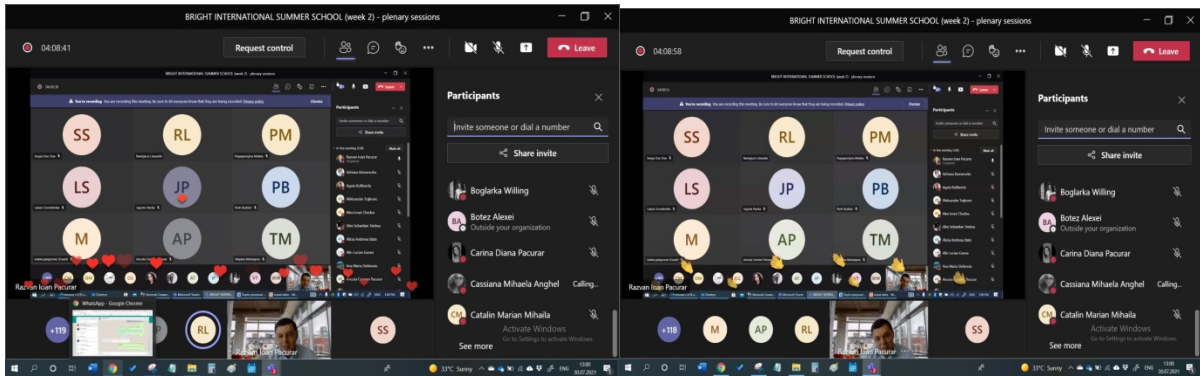




At the end of the first week of BRIGHT International Summer School, onsite visits were organized in the 3D printing laboratories of T.U. Cluj-Napoca (Romania). During the visits, the students received valuable feedbacks from the BRIGHT experts involved in the evaluation of the 3D-printed models.

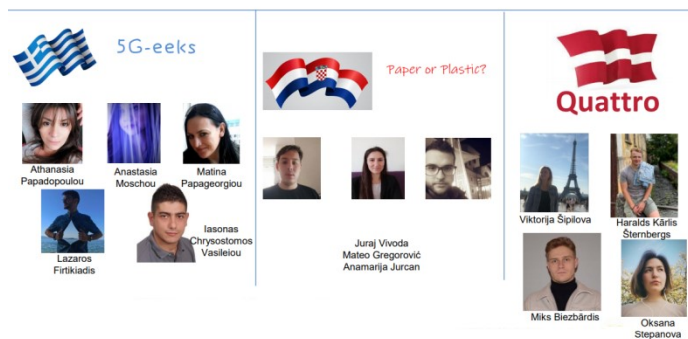


At the end of the second week of school, the students sat for a final test. They were also asked to answer a set of survey questions used for assessing the activity of the BRIGHT summer school (including the quality of the teaching material freely available on the MS Teams platform). On this occasion, many students addressed highly motivating messages to other colleagues potentially interested in attending future editions of the BRIGHT summer school.



**We all 3D print in the same language. You can do it!!**

Thank you!!



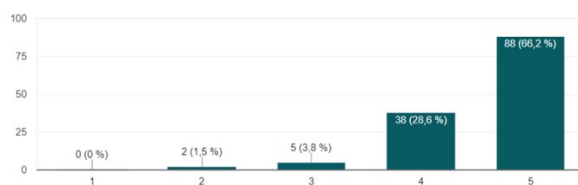
The BRIGHT International summer school provided the participants a good opportunity to promote their home countries. The images shown below are more than relevant from this point of view. Such relaxing activities strengthened the connections between participants and enhanced their cooperation in the frame of the BRIGHT International summer school 2021 edition.



Over 90% of the survey respondents positively evaluated the activities performed in the frame of the BRIGHT International summer school, while over 97% of them expressed their interest in attending its future activities (especially the summer school to be organized in Croatia during July 2022) as well as the availability to promote this educational project among their colleagues. In general, the questionnaire revealed a high degree of satisfaction and an active involvement of the respondents.

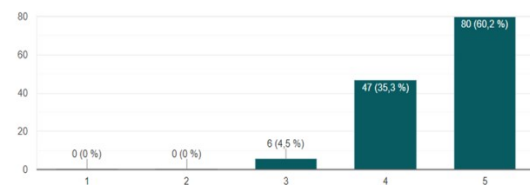
How would you rate the scientific level of the course modules prepared for the BRIGHT International summer school?

133 de răspunsuri



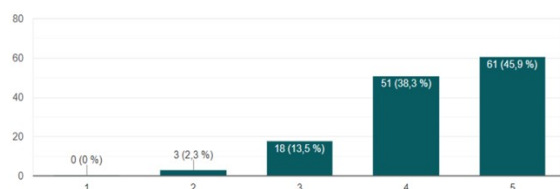
How would you rate the quality of the lecturers presentations?

133 de răspunsuri



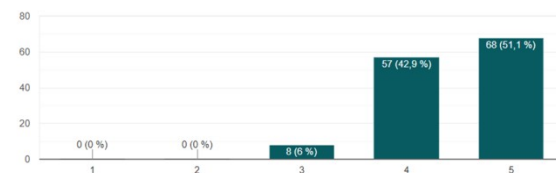
Was the BRIGHT International summer school relevant and in concordance to your needs?

133 de răspunsuri



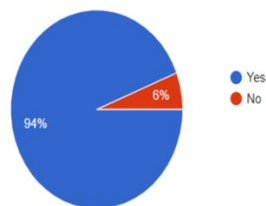
How would you rate the quality of the presentations held on the BRIGHT International summer school?

133 de răspunsuri



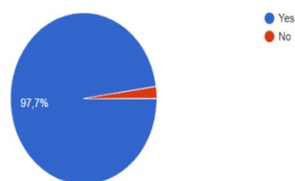
Did the content of the BRIGHT International summer school meet your expectations?

133 de răspunsuri



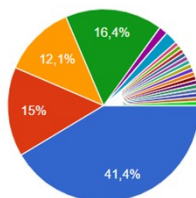
If BRIGHT International summer school will be organized in the future you will recommend this event to your friends / colleagues / etc.?

132 de răspunsuri



Specialization

133 de răspunsuri



- Manufacturing Engineering / Industrial...
- Computer Science
- Economics and Business
- Mechatronics and Robotics
- Computer Science and Automation
- Biochemistry
- Mechanical / Bio-Mechanical Engineer...
- Material Engineering
- Junior Survey Engineer
- Medical Engineering
- Material Science
- Material science
- Medicine
- Electrical engineering
- Chemical and processing engineering
- Biomedical Engineering
- High school student
- biomedical engineering
- Regenerative and Biopharmaceutical...
- Biomedical Engineering
- Microelectronics and nanotechnology
- Industrial design

**Strong motivation for the next BRIGHT International Summer school – 2022 edition - in Croatia - to be remembered by all of you! Be sure that you will be there next year dear BRIGHT students! 😊**

**Most active students at BRIGHT summer school will be supported by the BRIGHT consortium to apply for ERASMUS scholarships for the BRIGHT International Summer School to be organized next year in Croatia (Brijuni Island) (July 2022) + they will have the chance to apply and work for their diploma projects in the field of 3D printing / VR/ AR / medical applications with the support and under supervision of BRIGHT partners consortium)!!!**



At the end, the members of the BRIGHT consortium expressed their commitment to support the attendees in applying for being enrolled in the next edition of the BRIGHT International summer school. All the students who were actively involved in the current edition of the summer school received attendance certificates with the Erasmus+ label.

Finally, one should emphasize the great diversity of specializations and professional interests declared by the participants in the current edition of the summer school, as well as the cross-disciplinary character of the educational event organized by the Technical University of Cluj-Napoca and its partners in the BRIGHT consortium.

Assoc.Prof.Dr.Eng. Răzvan Păcurar

Coordinator of the ERASMUS KA 226 BRIGHT project

Technical University of Cluj-Napoca, Romania, Faculty of Industrial Engineering, Robotics and Production Management, Department of Manufacturing Engineering

Further details (including photographs) taken during the BRIGHT International Summer School – 2021 edition are available on the Internet page of the ERASMUS KA 226 BRIGHT project:

<https://bright-project.eu/>